



STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION

**NOTICE TO BIDDERS**  
**AND**  
**SPECIAL PROVISIONS**

**FOR CONSTRUCTION ON STATE HIGHWAY IN LOS ANGELES COUNTY ON ROUTE 710  
AT VARIOUS LOCATIONS FROM LOS ANGELES RIVER BRIDGE TO RAMONA  
BOULEVARD UNDERCROSSING**

**In District 07 On Route 710**

**Under**

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**Bid book dated October 10, 2011**

**Standard Specifications dated 2006**

**Project Plans approved June 27, 2011**

**Standard Plans dated 2006**

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**Identified by**

**Contract No. 07-202114**

**07-LA-710-17.2/26.4**

**Project ID 0700020869**

**Federal-Aid Project**

**ACNH-710-1(809)N**

**Electronic Advertising Contract**

Bids open Thursday, January 12, 2012

Dated October 10, 2011

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# SPECIAL NOTICES

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- Refer to Section 8-1.07, "Liquidated Damages," of the Amendments to the Standard Specifications for your project-specific liquidated damages based on your total bid.
- See Section 2, "Bidding," of these special provisions regarding SSPC QP certification.
- The Department is providing an electronic Information Handout for this project. Refer to Section 2-1.03B, "Supplemental Project Information," in the Amendments to the Standard Specifications for the location of this information.
- The Department is allowing contractors to submit electronic payroll records to the District Labor Compliance Office. Refer to section titled "Electronic Submission of Payroll Records" under Section 5, "General," of these special provisions.

# CONTRACT No. 07-202114

The special provisions contained herein have been prepared by or under the direction of the following Registered Persons.

## HIGHWAYS

*Rene Yin*

REGISTERED CIVIL ENGINEER



## HYDRAULIC

*Robert M. Henderson*

REGISTERED CIVIL ENGINEER



## MAINTAINING TRAFFIC (FREEWAY)

*Denis Katayama*

REGISTERED CIVIL ENGINEER



## MAINTAINING TRAFFIC (LOCAL STREETS)

*S. Moinuddin*

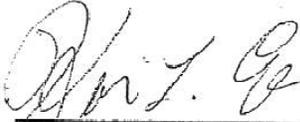
REGISTERED CIVIL ENGINEER



# CONTRACT NO. 07-202114

The special provisions contained herein have been prepared by or under the direction of the following Registered Persons.

## STRUCTURES



09/28/2011

REGISTERED CIVIL ENGINEER



## LANDSCAPE



LICENSED LANDSCAPE ARCHITECT



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# STANDARD PLANS LIST

The Standard Plan sheets applicable to this contract include, but are not limited to, those indicated below. Applicable Revised Standard Plans (RSP) and New Standard Plans (NSP) indicated below are included in the project plans as Standard Plan sheets.

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T5	Temporary Terminal Section (Type K)
RSP T7	Construction Project Funding Identification Signs
T10	Traffic Control System for Lane Closure On Freeways and Expressways
T10A	Traffic Control System for Lane and Complete Closures on Freeways and Expressways
T11	Traffic Control System for Lane Closure on Multilane Conventional Highways
T12	Traffic Control System for Lane Closure on Multilane Conventional Highways
T13	Traffic Control System for Lane Closure on Two Lane Conventional Highways
T14	Traffic Control System for Ramp Closure
T15	Traffic Control System for Moving Lane Closure on Multilane Highways
T16	Traffic Control System for Moving Lane Closure on Multilane Highways
T17	Traffic Control System for Moving Lane Closure on Two Lane Highways
RSP T56	Temporary Water Pollution Control Details (Temporary Fiber Roll)
T57	Temporary Water Pollution Control Details (Temporary Check Dam)
T58	Temporary Water Pollution Control Details (Temporary Construction Entrance)
NSP T62	Temporary Water Pollution Control Details (Temporary Drainage Inlet Protection)
B0-1	Bridge Details

B0-3	Bridge Details
B0-5	Bridge Details
B0-13	Bridge Details
B2-3	16" and 24" Cast-In-Drilled-Hole Concrete Pile
B2-5	Pile Details – Class 90 and Class 140
B3-1	Retaining Wall Type 1 – H = 4' through 30'
B3-2	Retaining Wall Type 1 – H = 32' through 36'
B3-8	Retaining Wall Details No. 1
B3-9	Retaining Wall Details No. 2
B6-10	Utility Openings, T-Beam
RSP B6-21	Joint Seals (Maximum Movement Rating = 2")
B7-1	Box Girder Details
B7-7	Deck Drains – Type D-3
B7-8	Deck Drainage Details
B7-10	Utility Opening – Box Girder
B8-5	Cast-In-Place Prestressed Girder Details
B11-7	Chain Link Railing
B11-47	Cable Railing
B11-55	Concrete Barrier Type 732
B11-56	Concrete Barrier Type 736
B14-3	Communication and Sprinkler Control Conduits (Conduit Less Than 4")
B14-4	Water Supply Line (Bridge) (Pipe Sizes Less Than 4")
RS1	Roadside Signs, Typical Installation Details No. 1
RS2	Roadside Signs – Wood Post, Typical Installation Details No. 2
RS3	Roadside Signs – Laminated Wood Box Post Typical Installation Details No. 3
RS4	Roadside Signs, Typical Installation Details No. 4
S1	Overhead Signs – Truss, Instructions and Examples
S2	Overhead Signs – Truss, Single Post Type – Post Type II thru IX
S3	Overhead Signs – Truss, Single Post Type – Base Plate and Anchorage Details
S4	Overhead Signs – Truss, Single Post Type – Structural Frame Members Details No. 1
S5	Overhead Signs – Truss, Single Post Type – Structural Frame Members Details No. 2
S6	Overhead Signs – Truss, Gusset Plate Details
S7	Overhead Signs – Truss, Single Post Type – Square Pedestal Pile Foundation
S9	Overhead Signs – Truss, Two Post Type – Post Types I-S thru VII-S
S10	Overhead Signs – Truss, Two Post Type – Base Plate and Anchorage Details
S11	Overhead Signs – Truss, Two Post Type – Structural Frame Members
S12	Overhead Signs – Truss, Structural Frame Details
S13	Overhead Signs – Truss, Frame Juncture Details
S14	Overhead Signs – Truss, Two Post Type – Square Pedestal Foundation
S16	Overhead Signs – Walkway Details No. 1
S17	Overhead Signs – Walkway Details No. 2
S17A	Overhead Signs – Walkway Details No. 3
S18	Overhead Signs – Walkway Safety Railing Details
S19	Overhead Signs – Truss, Sign Mounting Details – Laminated Panel – Type A
S20	Overhead Signs – Steel Frames – Removable Sign Panel Frames
S21	Overhead Signs – Removable Sign Panel Frames Mounting Details
S83	Roadside Laminated Sign – Single or Multiple Panel, Type B (2-1/2" Thick)
S84	Roadside Laminated Sign – Single or Multiple Panel, Type H (2-1/2" Thick)
S86	Laminated Panel Details – Extrusions for Type A, B and H Panels
S87	Type A-1 Mounting Hardware – Overhead Laminated Type A Panel, Truss and Lightweight Sign Structures
S88	Type A-2 Mounting Hardware – Overhead Laminated Type A Panel, Bridge Mounted and Tubular Sign Structures
S89	Roadside Sign – Formed Single Sheet Aluminum Panel
S90	Channel and Bolt Hole Location, Overhead Formed Sign Panel
S91	Overhead Sign – Formed Sign Panel, Type A-3 Mounting Hardware
S92	Overhead Formed Sign Panel

S93	Framing Details for Framed Single Sheet Aluminum Signs, Rectangular Shape
S94	Roadside Framed Single Sheet Aluminum Signs, Rectangular Shape
S95	Roadside Single Sheet Aluminum Signs, Diamond Shape
S101	Overhead Sign – Truss, Single Post Type, Layout, Unbalanced Butterfly Changeable Message Signs, Model 500
S102	Overhead Sign – Truss, Single Post Type, Structural Frame Details, Unbalanced Butterfly Changeable Message Signs, Model 500
S103	Overhead Sign – Truss, Single Post Type, Plan and Upper Bolt Details, Unbalanced Butterfly Changeable Message Signs, Model 500
S104	Overhead Sign – Truss, Single Post Type, Frame Juncture Details, Unbalanced Butterfly Changeable Message Signs, Model 500
S105	Overhead Sign – Truss, Single Post Type, Layout, Balanced Butterfly Changeable Message Signs, Model 500
S106	Overhead Sign – Truss, Single Post Type, Structural Frame Details, Balanced Butterfly Changeable Message Signs, Model 500
S107	Overhead Sign – Truss, Single Post Type, Plan and Upper Bolt Details, Balanced Butterfly Changeable Message Signs, Model 500
S108	Overhead Sign – Truss, Single Post Type, Frame Juncture Details, Balanced Butterfly Changeable Message Signs, Model 500
S109	Overhead Sign – Truss, Single Post Type, Layout, Full Cantilever Changeable Message Signs, Model 500
S110	Overhead Sign – Truss, Single Post Type, Structural Frame Details, Full Cantilever Changeable Message Signs, Model 500
S111	Overhead Sign – Truss, Single Post Type, Plan and Upper Bolt Details, Full Cantilever Changeable Message Signs, Model 500
S112	Overhead Sign – Truss, Single Post Type, Frame Juncture Details, Full Cantilever Changeable Message Signs, Model 500
S113	Overhead Sign – Truss, Single Post Type, Mounting Details, Changeable Message Signs, Model 500
S114	Overhead Sign – Truss, Single Post Type, Walkway Details, Changeable Message Signs, Model 500
S115	Overhead Sign – Truss, Single Post Type, Anchorage and Base Plate Details, Changeable Message Signs, Model 500
S116	Overhead Sign – Truss, Single Post Type, Foundation And Miscellaneous Details, Changeable Message Signs, Model 500
S140	Overhead Sign – Truss, Single Post Type, Walkway Safety Railing Details, Changeable Message Signs, Model 500 and 510
S141	Overhead Sign – Truss, Single Post Type, Safety Cable Anchorage Details, Changeable Message Signs, Model 500 and 510
S142	Overhead Sign – Truss, Single Post Type, Gusset Plate Details, Changeable Message Signs, Model 500 and 510
RSP ES-1A	Electrical Systems (Symbols and Abbreviations)
RSP ES-1B	Electrical Systems (Symbols and Abbreviations)
RSP ES-1C	Electrical Systems (Symbols and Abbreviations)
ES-2A	Electrical Systems (Service Equipment)
RSP ES-2C	Electrical Systems (Service Equipment Notes, Type III Series)
RSP ES-2F	Electrical Systems (Service Equipment and Typical Wiring Diagram Type III – C Series)
ES-3A	Electrical Systems (Controller Cabinet Details)
ES-3B	Electrical Systems (Controller Cabinet Details)
ES-3C	Electrical Systems (Controller Cabinet Details)
ES-4A	Electrical Systems (Signal Heads and Mountings)
ES-4B	Electrical Systems (Signal Heads and Mountings)
RSP ES-4C	Electrical Systems (Signal Heads and Mountings)
RSP ES-4D	Electrical Systems (Signal Heads and Mountings)
RSP ES-5A	Electrical Systems (Detectors)
ES-5B	Electrical Systems (Detectors)
ES-5D	Electrical Systems (Detectors)
RSP ES-6A	Electrical Systems (Lighting Standard, Types 15 and 21)

ES-6B	Electrical Systems (Lighting Standard, Types 15 and 21, Barrier Rail Mounted Details)
ES-6D	Electrical Systems (Lighting Standard, Types 15D and 21D, Double Arm)
RSP ES-6E	Electrical Systems (Lighting Standard, Types 30 and 31)
RSP ES-7B	Electrical Systems (Signal and Lighting Standard – Type 1 Standards and Equipment Numbering)
ES-7M	Electrical Systems (Signal and Lighting Standards – Details No. 1)
ES-7N	Electrical Systems (Signal and Lighting Standards – Details No. 2)
ES-8	Electrical Systems (Pull Box Details)
RSP ES-9A	Electrical Systems (Electrical Details, Structure Installations)
ES-9B	Electrical Systems (Electrical Details, Structure Installations)
RSP ES-9C	Electrical Systems (Electrical Details, Structure Installations)
ES-9D	Electrical Systems (Electrical Details, Structure Installations)
ES-9E	Electrical Systems (Electrical Details, Structure Installations)
ES-9F	Electrical Systems (Flush Soffit Luminaire Modification Details, Structure Installations)
ES-10	Electrical Systems (Isofootcandle Diagrams)
ES-11	Electrical Systems (Foundation Installations)
ES-13A	Electrical Systems (Splicing Details)
ES-13B	Electrical Systems (Wiring Details and Fuse Ratings)
ES-15A	Electrical Systems (Sign Illumination Equipment)
ES-15C	Electrical Systems (Sign Illumination Equipment)
RSP ES-15D	Electrical Systems (Lighting and Sign Illumination Control)
ES-16A	Electrical Systems (Closed Circuit Television, Pole Details)

# NOTICE TO BIDDERS

Bids open Thursday, January 12, 2012

Dated October 10, 2011

General work description: Pave roadway with long life pavement and widen roadway and bridges

The Department will receive sealed bids for CONSTRUCTION ON STATE HIGHWAY IN LOS ANGELES COUNTY ON ROUTE 710 AT VARIOUS LOCATIONS FROM LOS ANGELES RIVER BRIDGE TO RAMONA BOULEVARD UNDERCROSSING.

District-County-Route-Post Mile: 07-LA-710-17.2/26.4

Contract No. 07-202114

The Contractor must have either a Class A license or a combination of Class C licenses which constitutes a majority of the work.

The UDBE Contract goal is 9 percent.

Federal-aid project no.:  
ACNH-710-1(809)N

For the Federal training program, the number of trainees or apprentices is 58.

Bids must be on a unit price basis.

Complete the work, including plant establishment work, within 900 working days.

The estimated cost of the project is \$170,000,000.

No prebid meeting is scheduled for this project.

The Department will receive bids until 2:00 p.m. on the bid open date at 3347 Michelson Drive, Suite 100, Irvine, CA 92612-1692. Bids received after this time will not be accepted.

The Department will open and publicly read the bids at the above location immediately after the specified closing time.

District office addresses are provided in the Standard Specifications.

Bidders' inquiries may be presented to the Department by following the instructions at:

[http://www.dot.ca.gov/hq/esc/oe/project\\_status/bid\\_inq.html](http://www.dot.ca.gov/hq/esc/oe/project_status/bid_inq.html)

The Department posts responses to the questions at the District Web sites.

Questions about alleged patent ambiguity of the plans, specifications, or estimate must be asked before bid opening. After bid opening, such questions will not be treated as bid protests.

Submit your bid with bidder's security equal to at least 10 percent of the bid.

Prevailing wages are required on this Contract. The Director of the California Department of Industrial Relations determines the general prevailing wage rates. Obtain the wage rates at the DIR Web site, <http://www.dir.ca.gov>, or from the Department's Labor Compliance Office of the district in which the work is located.

The federal minimum wage rates for this Contract as determined by the United States Secretary of Labor are available at <http://www.dot.ca.gov/hq/esc/oe/federal-wages>.

If the minimum wage rates as determined by the United States Secretary of Labor differs from the general prevailing wage rates determined by the Director of the California Department of Industrial Relations for similar classifications of labor, the Contractor and subcontractors must not pay less than the higher wage rate. The Department does not accept lower State wage rates not specifically included in the Federal minimum wage determinations. This includes helper, or other classifications based on hours of experience, or any other classification not appearing in the Federal wage determinations. Where Federal wage determinations do not contain the State wage rate determination otherwise available for use by the Contractor and subcontractors, the Contractor and subcontractors must not pay less than the Federal minimum wage rate that most closely approximates the duties of the employees in question.

The Department has made available Notices of Suspension and Proposed Debarment from the Federal Highway Administration. For a copy of the notices go to [http://www.dot.ca.gov/hq/esc/oe/contractor\\_info](http://www.dot.ca.gov/hq/esc/oe/contractor_info). Additional information is listed in the Excluded Parties List System at <https://www.epls.gov>.

DEPARTMENT OF TRANSPORTATION

NRA

**COPY OF BID ITEM LIST**

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
1	070012	PROGRESS SCHEDULE (CRITICAL PATH METHOD)	LS	LUMP SUM
2	070018	TIME-RELATED OVERHEAD	WDAY	720
3	021291	TEMPORARY 12" BITUMINOUS COATED CORRUGATED STEEL PIPE RISER (0.079" THICK)	LF	85
4	021292	TEMPORARY 18" BITUMINOUS COATED SLOTTED CORRUGATED STEEL PIPE (0.079" THICK)	LF	6,610
5	074016	CONSTRUCTION SITE MANAGEMENT	LS	LUMP SUM
6	074019	PREPARE STORM WATER POLLUTION PREVENTION PLAN	LS	LUMP SUM
7	021293	GROSS SOLIDS REMOVAL DEVICE (LR-1)	EA	1
8	021294	GROSS SOLIDS REMOVAL DEVICE (LR-2)	EA	2
9	021295	GROSS SOLIDS REMOVAL DEVICE (INCLINED SCREEN TYPE A)	EA	1
10	074028	TEMPORARY FIBER ROLL	LF	84,100
11	074031	TEMPORARY GRAVEL BAG BERM	LF	3,000
12	074033	TEMPORARY CONSTRUCTION ENTRANCE	EA	8
13	074035	TEMPORARY CHECK DAM	LF	1,090
14	074037	MOVE-IN/MOVE-OUT (TEMPORARY EROSION CONTROL)	EA	8
15	074038	TEMPORARY DRAINAGE INLET PROTECTION	EA	240
16	074040	TEMPORARY HYDRAULIC MULCH (BONDED FIBER MATRIX)	SQYD	78,900
17	074041	STREET SWEEPING	LS	LUMP SUM
18	074043	TEMPORARY CONCRETE WASHOUT BIN	EA	8
19	074056	RAIN EVENT ACTION PLAN	EA	105
20	074057	STORM WATER ANNUAL REPORT	EA	4

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
21	074058	STORM WATER SAMPLING AND ANALYSIS DAY	EA	54
22	120090	CONSTRUCTION AREA SIGNS	LS	LUMP SUM
23	120100	TRAFFIC CONTROL SYSTEM	LS	LUMP SUM
24	120116	TYPE II BARRICADE	EA	16
25	120120	TYPE III BARRICADE	EA	328
26	120151	TEMPORARY TRAFFIC STRIPE (TAPE)	LF	237,000
27	120159	TEMPORARY TRAFFIC STRIPE (PAINT)	LF	486,000
28	120165	CHANNELIZER (SURFACE MOUNTED)	EA	1,570
29	120300	TEMPORARY PAVEMENT MARKER	EA	9,880
30	121161	TEMPORARY TERMINAL SECTION (TYPE K)	EA	15
31	129000	TEMPORARY RAILING (TYPE K)	LF	125,560
32	021296	MOVEABLE CONCRETE BARRIER	LS	LUMP SUM
33	129100	TEMPORARY CRASH CUSHION MODULE	EA	794
34	141103	REMOVE YELLOW THERMOPLASTIC TRAFFIC STRIPE (HAZARDOUS WASTE)	LF	75,900
35	148005	NOISE MONITORING	LS	LUMP SUM
36	150206	ABANDON CULVERT	LF	600
37	150221	ABANDON INLET	EA	5
38	150305	OBLITERATE SURFACING	SQYD	1,350
39	150608	REMOVE CHAIN LINK FENCE	LF	1,350
40	150662	REMOVE METAL BEAM GUARD RAILING	LF	14,800

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
41	021297	REMOVE SINGLE THRIE BEAM BARRIER (STEEL POST)	LF	3,860
42	150676	REMOVE CABLE RAILING	LF	380
43	150711	REMOVE PAINTED TRAFFIC STRIPE	LF	240,000
44	150713	REMOVE PAVEMENT MARKING	SQFT	770
45	150714	REMOVE THERMOPLASTIC TRAFFIC STRIPE	LF	80,000
46	150722	REMOVE PAVEMENT MARKER	EA	25,400
47	150730	REMOVE CHANNELIZERS	EA	18
48	150742	REMOVE ROADSIDE SIGN	EA	41
49	150760	REMOVE SIGN STRUCTURE	EA	20
50	150767	REMOVE BRIDGE MOUNTED SIGN	EA	4
51	021500	REMOVE ASPHALT CONCRETE DIKE	LF	410
52	150801	REMOVE OVERSIDE DRAIN	EA	2
53	150805	REMOVE CULVERT	LF	6,090
54	150820	REMOVE INLET	EA	65
55	150821	REMOVE HEADWALL	EA	5
56	150829	REMOVE RETAINING WALL	LF	780
57	150846	REMOVE CONCRETE PAVEMENT	CY	33,000
58	150857	REMOVE ASPHALT CONCRETE SURFACING	SQFT	710
59	150870	REMOVE CONCRETE DECK SURFACE	SQFT	2,340
60	151274	SALVAGE CONCRETE BARRIER (TYPE K)	LF	640

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
61	021298	SALVAGE PORTABLE CONCRETE BARRIER (TYPE 60K)	LF	1,560
62	152390	RELOCATE ROADSIDE SIGN	EA	1
63	152430	ADJUST INLET	EA	42
64	152440	ADJUST MANHOLE TO GRADE	EA	1
65	152752	REPLACE SIGN PANEL (ROADSIDE SIGN)	EA	4
66	153210	REMOVE CONCRETE	CY	11
67	021299	REMOVE CONCRETE (GUTTER)	LF	380
68	153214	REMOVE CONCRETE CURB	CY	1,220
69	153218	REMOVE CONCRETE SIDEWALK	CY	5
70	153221	REMOVE CONCRETE BARRIER	LF	15,230
71	153223	REMOVE UNSOUND CONCRETE	CF	390
72	153225	PREPARE CONCRETE BRIDGE DECK SURFACE	SQFT	7,690
73	153235	CLEAN BRIDGE DECK	SQFT	70,100
74	153250	REMOVE SOUND WALL	LF	370
75	153530	ACCESS OPENING, DECK	EA	13
76	155003	CAP INLET	EA	46
77	155006	CAP RISER	EA	10
78	156590	REMOVE CRASH CUSHION (SAND FILLED)	EA	11
79	157550	BRIDGE REMOVAL	LS	LUMP SUM
80	157561	BRIDGE REMOVAL (PORTION), LOCATION A	LS	LUMP SUM

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
81	157562	BRIDGE REMOVAL (PORTION), LOCATION B	LS	LUMP SUM
82	157563	BRIDGE REMOVAL (PORTION), LOCATION C	LS	LUMP SUM
83	157564	BRIDGE REMOVAL (PORTION), LOCATION D	LS	LUMP SUM
84	157565	BRIDGE REMOVAL (PORTION), LOCATION E	LS	LUMP SUM
85	157566	BRIDGE REMOVAL (PORTION), LOCATION F	LS	LUMP SUM
86	157567	BRIDGE REMOVAL (PORTION), LOCATION G	LS	LUMP SUM
87	160101	CLEARING AND GRUBBING	LS	LUMP SUM
88	190101	ROADWAY EXCAVATION	CY	172,000
89	190105	ROADWAY EXCAVATION (TYPE Z-2) (AERIALY DEPOSITED LEAD)	CY	19,300
90	190107	ROADWAY EXCAVATION (TYPE Y-1) (AERIALY DEPOSITED LEAD)	CY	8,820
91	190110	LEAD COMPLIANCE PLAN	LS	LUMP SUM
92	190111	ADL BURIAL LOCATION REPORT	LS	LUMP SUM
93 (F)	192003	STRUCTURE EXCAVATION (BRIDGE)	CY	3,265
94 (F)	192037	STRUCTURE EXCAVATION (RETAINING WALL)	CY	10,655
95 (F)	192049	STRUCTURE EXCAVATION (SOLDIER PILE WALL)	CY	390
96 (F)	192053	STRUCTURE EXCAVATION (TYPE Z-2) (AERIALY DEPOSITED LEAD)	CY	5,507
97 (F)	192057	STRUCTURE EXCAVATION (TYPE Y-1) (AERIALY DEPOSITED LEAD)	CY	672
98 (F)	193003	STRUCTURE BACKFILL (BRIDGE)	CY	4,773
99 (F)	193013	STRUCTURE BACKFILL (RETAINING WALL)	CY	11,153
100 (F)	193029	STRUCTURE BACKFILL (SOLDIER PILE WALL)	CY	190

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
101 (F)	193031	PERVIOUS BACKFILL MATERIAL (RETAINING WALL)	CY	1,435
102	193114	SAND BACKFILL	CY	85
103 (F)	193116	CONCRETE BACKFILL (SOLDIER PILE WALL)	CY	370
104 (F)	193119	LEAN CONCRETE BACKFILL	CY	116
105	021300	DITCH EXCAVATION (TYPE Z-2) (AERIALY DEPOSITED LEAD)	CY	970
106	200001	HIGHWAY PLANTING	LS	LUMP SUM
107	200114	ROCK BLANKET	SQYD	530
108	203026	MOVE-IN/MOVE-OUT (EROSION CONTROL)	EA	1
109	203031	EROSION CONTROL (HYDROSEED) (SQFT)	SQFT	31,200
110	204099	PLANT ESTABLISHMENT WORK	LS	LUMP SUM
111	208000	IRRIGATION SYSTEM	LS	LUMP SUM
112	260201	CLASS 2 AGGREGATE BASE	CY	1
113	260210	AGGREGATE BASE (APPROACH SLAB)	CY	36
114	260301	CLASS 3 AGGREGATE BASE	CY	43,600
115	280000	LEAN CONCRETE BASE	CY	16,800
116	021301	LEAN CONCRETE BASE (RAPID SETTING)	CY	29,600
117	390131	HOT MIX ASPHALT	TON	10,220
118	390132	HOT MIX ASPHALT (TYPE A)	TON	2
119	391007	PAVING ASPHALT (BINDER, GEOSYNTHETIC PAVEMENT INTERLAYER)	TON	3
120	393003	GEOSYNTHETIC PAVEMENT INTERLAYER	SQYD	1,990

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
121	394060	DATA CORE	LS	LUMP SUM
122	394073	PLACE HOT MIX ASPHALT DIKE (TYPE A)	LF	7,100
123	394074	PLACE HOT MIX ASPHALT DIKE (TYPE C)	LF	2,080
124	394076	PLACE HOT MIX ASPHALT DIKE (TYPE E)	LF	8,910
125	394077	PLACE HOT MIX ASPHALT DIKE (TYPE F)	LF	14,200
126	394090	PLACE HOT MIX ASPHALT (MISCELLANEOUS AREA)	SQYD	11
127	401050	JOINTED PLAIN CONCRETE PAVEMENT	CY	34,500
128	021302	PRECAST PRESTRESSED CONCRETE PAVEMENT	CY	27,700
129	021303	JOINTED PLAIN CONCRETE PAVEMENT (RAPID STRENGTH CONCRETE 400 PSI)	CY	18,300
130	021304	JOINTED PLAIN CONCRETE PAVEMENT (RAPID STRENGTH CONCRETE 550 PSI)	CY	5,700
131	404092	SEAL PAVEMENT JOINT	LF	89,800
132	404094	SEAL LONGITUDINAL ISOLATION JOINT	LF	71,000
133	406003	TIE BAR (DRILL AND BOND)	EA	7,780
134	406050	DOWEL BAR (DRILL AND BOND)	EA	840
135	406100	DOWEL BAR RETROFIT	EA	890
136	021305	REPAIR SPALLED JOINTS (POLYESTER GROUT)	SQYD	895
137	021306	GRIND CONCRETE PAVEMENT	SQYD	340,600
138	021307	STEEL SOLDIER PILE (HP 14 X 117)	LF	1,720
139	021308	STEEL SOLDIER PILE (HP 14 X 89)	LF	870
140	021309	30" DRILLED HOLE	LF	2,670

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
141	490520	FURNISH STEEL PILING (HP 12 X 84)	LF	3,990
142	490521	DRIVE STEEL PILE (HP 12 X 84)	EA	86
143	490538	FURNISH STEEL PILING (HP 14 X 117)	LF	4,920
144	490539	DRIVE STEEL PILE (HP 14 X 117)	EA	100
145	490601	16" CAST-IN-DRILLED-HOLE CONCRETE PILING	LF	3,364
146	490603	24" CAST-IN-DRILLED-HOLE CONCRETE PILING	LF	338
147	490608	54" CAST-IN-DRILLED-HOLE CONCRETE PILING	LF	210
148	490610	66" CAST-IN-DRILLED-HOLE CONCRETE PILING	LF	1,050
149	490614	78" CAST-IN-DRILLED-HOLE CONCRETE PILING	LF	210
150	490742	FURNISH PILING (CLASS 90) (ALTERNATIVE W)	LF	6,370
151	490743	DRIVE PILE (CLASS 90) (ALTERNATIVE W)	EA	145
152	490746	FURNISH PILING (CLASS 140) (ALTERNATIVE W)	LF	14,870
153	490747	DRIVE PILE (CLASS 140) (ALTERNATIVE W)	EA	291
154	043276	MICROPILE (NPS 12 XX-STRONG)	EA	6
155	500001	PRESTRESSING CAST-IN-PLACE CONCRETE	LS	LUMP SUM
156 (F)	510051	STRUCTURAL CONCRETE, BRIDGE FOOTING	CY	1,247
157 (F)	510053	STRUCTURAL CONCRETE, BRIDGE	CY	5,877
158 (F)	510060	STRUCTURAL CONCRETE, RETAINING WALL	CY	4,976
159 (F)	510086	STRUCTURAL CONCRETE, APPROACH SLAB (TYPE N)	CY	400
160	510087	STRUCTURAL CONCRETE, APPROACH SLAB (TYPE R)	CY	346

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
161 (F)	021311	STRUCTURAL CONCRETE CHANNEL INVERT SLAB	CY	300
162 (F)	510502	MINOR CONCRETE (MINOR STRUCTURE)	CY	428
163 (F)	021312	MINOR CONCRETE (MINOR STRUCTURE) ANCHOR BLOCK	CY	12.5
164 (F)	510524	MINOR CONCRETE (SOUND WALL)	CY	7
165 (F)	510526	MINOR CONCRETE (BACKFILL)	CY	23
166	510800	PAVING NOTCH EXTENSION	CF	245
167 (F)	511064	FRACTURED RIB TEXTURE	SQFT	3,555
168 (F)	021313	RIB TEXTURE (VERTICLE AND DIAGONAL)	SQFT	840
169	511106	DRILL AND BOND DOWEL	LF	2,641
170	511110	DRILL AND BOND DOWEL (CHEMICAL ADHESIVE)	EA	156
171	511124	RAPID SETTING CONCRETE (PATCH)	CF	390
172	511125	CLOSE ACCESS, DECK	EA	13
173	021314	FURNISH PRECAST PRESTRESSED RECTANGULAR CONCRETE GIRDER (70'-80')	EA	6
174	021315	FURNISH PRECAST PRESTRESSED RECTANGULAR CONCRETE GIRDER (80'-90')	EA	7
175	021316	FURNISH PRECAST PRESTRESSED CONCRETE U-GIRDER (60'-70')	EA	1
176	021317	FURNISH PRECAST PRESTRESSED CONCRETE U-GIRDER (90'-100')	EA	1
177 (F)	021318	ERECT PRECAST PRESTRESSED RECTANGULAR CONCRETE GIRDER	EA	13
178 (F)	021319	ERECT PRECAST PRESTRESSED CONCRETE U-GIRDER	EA	2
179	515020	REFINISH BRIDGE DECK	SQFT	2,719
180	515041	FURNISH POLYESTER CONCRETE OVERLAY	CF	810

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
181 (F)	515042	PLACE POLYESTER CONCRETE OVERLAY	SQFT	7,690
182	515061	CORE CONCRETE (2")	LF	65
183	021320	CORE CONCRETE (13')	LF	9
184	021321	CORE AND PRESSURE GROUT DOWEL	LF	1,750
185 (F)	518002	SOUND WALL (MASONRY BLOCK)	SQFT	3,150
186	519081	JOINT SEAL (MR 1/2")	LF	442
187	519088	JOINT SEAL (MR 1")	LF	150
188	519091	JOINT SEAL (MR 1 1/2")	LF	50
189	519100	JOINT SEAL (MR 2")	LF	149
190	519102	JOINT SEAL (TYPE AL)	LF	750
191	021322	BONDED JOINT SEAL (MR 2 1/2")	LF	14
192 (F)	520101	BAR REINFORCING STEEL	LB	13,900
193 (F)	520102	BAR REINFORCING STEEL (BRIDGE)	LB	2,057,300
194 (F)	520103	BAR REINFORCING STEEL (RETAINING WALL)	LB	1,011,400
195 (F)	520110	BAR REINFORCING STEEL (EPOXY COATED) (BRIDGE)	LB	860
196 (F)	520120	HEADED BAR REINFORCEMENT	EA	76
197 (F)	540102	TREAT BRIDGE DECK	SQFT	70,100
198	540108	FURNISH BRIDGE DECK TREATMENT MATERIAL	GAL	470
199	021323	PUBLIC SAFETY PLAN	LS	LUMP SUM
200 (F)	550203	FURNISH STRUCTURAL STEEL (BRIDGE)	LB	1,000,000

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
201 (F)	550204	ERECT STRUCTURAL STEEL (BRIDGE)	LB	1,000,000
202 (F)	560218	FURNISH SIGN STRUCTURE (TRUSS)	LB	587,589
203 (F)	560219	INSTALL SIGN STRUCTURE (TRUSS)	LB	587,589
204	560233	FURNISH FORMED PANEL SIGN (OVERHEAD)	SQFT	8,790
205	560245	FURNISH LAMINATED PANEL SIGN (1"-TYPE B)	SQFT	210
206	560246	FURNISH LAMINATED PANEL SIGN (2 1/2"-TYPE B)	SQFT	480
207	560248	FURNISH SINGLE SHEET ALUMINUM SIGN (0.063"-UNFRAMED)	SQFT	120
208	560249	FURNISH SINGLE SHEET ALUMINUM SIGN (0.080"-UNFRAMED)	SQFT	540
209	560251	FURNISH SINGLE SHEET ALUMINUM SIGN (0.063"-FRAMED)	SQFT	45
210	560252	FURNISH SINGLE SHEET ALUMINUM SIGN (0.080"-FRAMED)	SQFT	95
211	561016	60" CAST-IN-DRILLED-HOLE CONCRETE PILE (SIGN FOUNDATION)	LF	800
212	562002	METAL (BARRIER MOUNTED SIGN)	LB	830
213	566011	ROADSIDE SIGN - ONE POST	EA	36
214	566012	ROADSIDE SIGN - TWO POST	EA	9
215	568001	INSTALL SIGN (STRAP AND SADDLE BRACKET METHOD)	EA	11
216	568016	INSTALL SIGN PANEL ON EXISTING FRAME	SQFT	1,600
217	021324	INSTALL SIGN PANEL ON BARRIER/SOUND WALL	EA	1
218 (F)	570115	ABUTMENT LUMBER BLOCKING	MFBM	6.1
219 (F)	575004	TIMBER LAGGING	MFBM	24
220	590115	CLEAN AND PAINT STRUCTURAL STEEL	LS	LUMP SUM

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
221	590135	SPOT BLAST CLEAN AND PAINT UNDERCOAT	SQFT	260
222	620060	12" ALTERNATIVE PIPE CULVERT	LF	170
223	620100	18" ALTERNATIVE PIPE CULVERT	LF	2,450
224	620140	24" ALTERNATIVE PIPE CULVERT	LF	1,670
225	021325	3" PLASTIC PIPE (SCHEDULE 40 PVC)	LF	560
226	665117	18" BITUMINOUS COATED CORRUGATED STEEL PIPE (.079" THICK)	LF	150
227	665123	24" BITUMINOUS COATED CORRUGATED STEEL PIPE (.079" THICK)	LF	320
228	665812	12" BITUMINOUS COATED SLOTTED CORRUGATEDSTEEL PIPE (.079" THICK)	LF	640
229	665817	18" BITUMINOUS COATED SLOTTED CORRUGATEDSTEEL PIPE (.079" THICK)	LF	450
230	680905	8" PERFORATED PLASTIC PIPE UNDERDRAIN	LF	5,490
231	703233	GRATED LINE DRAIN	LF	620
232	703311	12" BITUMINOUS COATED CORRUGATED STEEL PIPE RISER (.079" THICK)	LF	20
233	703338	36" BITUMINOUS COATED CORRUGATED STEEL PIPE RISER (.079" THICK)	LF	5
234	703450	WELDED STEEL PIPE CASING (BRIDGE)	LF	77
235	705311	18" ALTERNATIVE FLARED END SECTION	EA	2
236	705315	24" ALTERNATIVE FLARED END SECTION	EA	3
237	721009	ROCK SLOPE PROTECTION (FACING, METHOD B)	CY	100
238 (F)	721430	CONCRETE (CHANNEL LINING)	CY	12
239	729010	ROCK SLOPE PROTECTION FABRIC	SQYD	270
240	021326	MINOR CONCRETE (CURB, SIDEWALK AND DRIVEWAY)	CY	200

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
241 (F)	731517	MINOR CONCRETE (GUTTER)	CY	184
242	731519	MINOR CONCRETE (STAMPED CONCRETE)	SQFT	31,010
243 (F)	750001	MISCELLANEOUS IRON AND STEEL	LB	88,328
244 (F)	750041	ISOLATION CASING	LB	6,100
245 (F)	750498	MISCELLANEOUS METAL (RESTRAINER - CABLE TYPE)	LB	11,360
246 (F)	750501	MISCELLANEOUS METAL (BRIDGE)	LB	32,405
247 (F)	750505	BRIDGE DECK DRAINAGE SYSTEM	LB	18,400
248	800360	CHAIN LINK FENCE (TYPE CL-6)	LF	1,200
249	021327	3" CHAIN LINK GATE (TYPE CL-5)	EA	4
250	802500	3' CHAIN LINK GATE (TYPE CL-6)	EA	1
251	802540	8' CHAIN LINK GATE (TYPE CL-6)	EA	2
252	820140	OBJECT MARKER (TYPE PB)	LF	1
253	820180	INSTALL MEDIAN MILEAGE PANEL	EA	34
254	832003	METAL BEAM GUARD RAILING (WOOD POST)	LF	12,900
255	021328	BURIED POST AND ANCHOR	EA	2
256 (F)	833020	CHAIN LINK RAILING	LF	34
257 (F)	833032	CHAIN LINK RAILING (TYPE 7)	LF	124
258	839302	SINGLE THRIE BEAM BARRIER (WOOD POST)	LF	160
259	839304	SINGLE THRIE BEAM BARRIER (BRIDGE)	LF	70
260 (F)	839521	CABLE RAILING	LF	4,516

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
261	839541	TRANSITION RAILING (TYPE WB)	EA	32
262	839581	END ANCHOR ASSEMBLY (TYPE SFT)	EA	19
263	839584	ALTERNATIVE IN-LINE TERMINAL SYSTEM	EA	8
264	839585	ALTERNATIVE FLARED TERMINAL SYSTEM	EA	21
265	839591	CRASH CUSHION, SAND FILLED	EA	42
266	839604	CRASH CUSHION (REACT 9CBB)	EA	1
267	839701	CONCRETE BARRIER (TYPE 60)	LF	1,130
268	839704	CONCRETE BARRIER (TYPE 60D)	LF	4,560
269	021329	CONCRETE BARRIER (TYPE 60E MODIFIED)	LF	370
270	839706	CONCRETE BARRIER (TYPE 60G)	LF	1,730
271	839708	CONCRETE BARRIER (TYPE 60GC)	LF	1,580
272	021330	CONCRETE BARRIER (TYPE 60GE MODIFIED)	LF	370
273	839710	CONCRETE BARRIER (TYPE 60S)	LF	1,390
274	839712	CONCRETE BARRIER (TYPE 60SC)	LF	180
275	839713	CONCRETE BARRIER (TYPE 60SE)	LF	190
276	021331	CONCRETE BARRIER (TYPE 60W MODIFIED)	LF	5,760
277 (F)	839717	CONCRETE BARRIER (TYPE 732 MODIFIED)	LF	1,552
278	021332	CONCRETE BARRIER (TYPE 60R)	LF	70
279 (F)	839720	CONCRETE BARRIER (TYPE 732)	LF	820
280 (F)	839721	CONCRETE BARRIER (TYPE 732A)	LF	314

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
281	021333	CONCRETE BARRIER (TYPE 60GCR)	LF	1,100
282	839723	CONCRETE BARRIER (TYPE 732B)	LF	140
283	021334	CONCRETE BARRIER (TYPE 60SW MODIFIED)	LF	3,200
284 (F)	839725	CONCRETE BARRIER (TYPE 736)	LF	931
285 (F)	839726	CONCRETE BARRIER (TYPE 736A)	LF	1,156
286 (F)	839727	CONCRETE BARRIER (TYPE 736 MODIFIED)	LF	1,760
287 (F)	839728	CONCRETE BARRIER (TYPE 736R)	LF	194
288 (F)	021335	CONCRETE BARRIER (TYPE 736 MODIFIED 1)	LF	619
289	839731	CONCRETE BARRIER (TYPE 736B)	LF	180
290	021336	CONCRETE BARRIER (TYPE 736B MODIFIED 1)	LF	180
291	021337	CONCRETE BARRIER (TYPE 732SV)	LF	120
292 (F)	021338	CONCRETE BARRIER (TYPE 60SA MOD)	LF	503
293 (F)	021339	CONCRETE BARRIER (TYPE 732B MOD)	LF	132
294 (F)	021340	CONCRETE BARRIER (TYPE 736A MOD)	LF	56
295 (F)	021341	CONCRETE BARRIER (TYPE 732 MOD 1)	LF	794
296	840504	4" THERMOPLASTIC TRAFFIC STRIPE	LF	113,255
297	840506	8" THERMOPLASTIC TRAFFIC STRIPE	LF	15,470
298	840508	8" THERMOPLASTIC TRAFFIC STRIPE (BROKEN 12-3)	LF	10,600
299	840515	THERMOPLASTIC PAVEMENT MARKING	SQFT	1,900
300	840525	4" THERMOPLASTIC TRAFFIC STRIPE (BROKEN 36-12)	LF	131,000

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
301	840526	4" THERMOPLASTIC TRAFFIC STRIPE (BROKEN 17-7)	LF	7,200
302	840656	PAINT TRAFFIC STRIPE (2-COAT)	LF	75,300
303	840660	PAINT PAVEMENT MARKING	SQFT	670
304	850101	PAVEMENT MARKER (NON-REFLECTIVE)	EA	10,900
305	850111	PAVEMENT MARKER (RETROREFLECTIVE)	EA	10,900
306	860090	MAINTAINING EXISTING TRAFFIC MANAGEMENT SYSTEM ELEMENTS DURING CONSTRUCTION	LS	LUMP SUM
307	860400	LIGHTING (TEMPORARY)	LS	LUMP SUM
308	021342	LIGHTING (BIKEWAY)	LS	LUMP SUM
309	860889	MODIFY TRAFFIC MONITORING STATION	LS	LUMP SUM
310	021343	MODIFY AUTOMATIC VEHICLE CLASSIFICATION STATION	LS	LUMP SUM
311	861088	MODIFY RAMP METERING SYSTEM	LS	LUMP SUM
312	861504	MODIFY LIGHTING AND SIGN ILLUMINATION	LS	LUMP SUM
313	021344	COMMUNICATION SYSTEM	LS	LUMP SUM
314	021345	CHANGEABLE MESSAGE SIGN SYSTEM (LOCATION 255)	LS	LUMP SUM
315	021346	CHANGEABLE MESSAGE SIGN SYSTEM (LOCATION LB257)	LS	LUMP SUM
316	021347	CLOSED CIRCUIT TELEVISION CAMERA (LOCATION LB210)	LS	LUMP SUM
317	021348	CLOSED CIRCUIT TELEVISION CAMERA (LOCATION LB219)	LS	LUMP SUM
318	021349	CLOSED CIRCUIT TELEVISION CAMERA (LOCATION LB231)	LS	LUMP SUM
319	021350	CLOSED CIRCUIT TELEVISION CAMERA (LOCATION LB237)	LS	LUMP SUM
320	021351	CLOSED CIRCUIT TELEVISION CAMERA (LOCATION LB245)	LS	LUMP SUM

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
321	021352	CLOSED CIRCUIT TELEVISION CAMERA (LOCATION LB257)	LS	LUMP SUM
322	021353	VIDEO NODE (LOCATION LB237)	LS	LUMP SUM
323	021354	DATA NODE (LOCATION LB237)	LS	LUMP SUM
324	021355	TRAFFIC MONITORING STATION (LOCATION 2705)	LS	LUMP SUM
325	021356	TRAFFIC MONITORING STATION (LOCATION 2706)	LS	LUMP SUM
326	021357	TRAFFIC MONITORING STATION (LOCATION 2305)	LS	LUMP SUM
327	869075	SYSTEM TESTING AND DOCUMENTATION	LS	LUMP SUM
328	999990	MOBILIZATION	LS	LUMP SUM

# SPECIAL PROVISIONS

## SECTION 1 (BLANK)

## SECTION 2 BIDDING

### 2-1.01 TIE BID RESOLUTION

After bid verification, if there is a tie between 2 or more bidders, the Department breaks the tie by tossing a coin.

### 2-1.02 DISADVANTAGED BUSINESS ENTERPRISES

Under 49 CFR 26.13(b):

The contractor, sub recipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate.

Take necessary and reasonable steps to ensure that DBEs have opportunity to participate in the contract (49 CFR 26).

To ensure there is equal participation of the DBE groups specified in 49 CFR 26.5, the Department specifies a goal for Underutilized Disadvantaged Business Enterprises (UDBEs). UDBE is a firm that meets the definition of DBE and is a member of one of the following groups:

1. Black Americans
2. Native Americans
3. Asian-Pacific Americans
4. Women

References to DBEs include UDBEs, but references to UDBEs do not include all DBEs.

Make work available to UDBEs and select work parts consistent with available UDBE subcontractors and suppliers.

Meet the UDBE goal shown in the Notice to Bidders or demonstrate that you made adequate good faith efforts to meet this goal.

It is your responsibility to verify that the UDBE firm is certified as DBE at date of bid opening. For a list of DBEs certified by the California Unified Certification Program, go to:

[http://www.dot.ca.gov/hq/bep/find\\_certified.htm](http://www.dot.ca.gov/hq/bep/find_certified.htm)

Only UDBE participation will count towards the UDBE goal. DBE participation will count towards the Department's federally mandated statewide overall DBE goal.

Credit for materials or supplies you purchase from UDBEs counts towards the goal in the following manner:

1. 100 percent counts if the materials or supplies are obtained from a UDBE manufacturer.
2. 60 percent counts if the materials or supplies are obtained from a UDBE regular dealer.
3. Only fees, commissions, and charges for assistance in the procurement and delivery of materials or supplies count if obtained from a UDBE that is neither a manufacturer or regular dealer. 49 CFR 26.55 defines "manufacturer" and "regular dealer."

You receive credit towards the goal if you employ a UDBE trucking company that performs a commercially useful function as defined in 49 CFR 26.55(d)(1) through (4) and (6).

### UDBE Commitment Submittal

Submit UDBE information on the Caltrans Bidder - UDBE - Commitment form included in the Bid book. If the form is not submitted with the bid, remove the form from the Bid book before submitting your bid.

If the UDBE Commitment form is not submitted with the bid, the apparent low bidder, the 2nd low bidder, and the 3rd low bidder must complete and submit the UDBE Commitment form to Office Engineer. UDBE Commitment form must be received by the Department no later than 4:00 p.m. on the 4th business day after bid opening.

Other bidders do not need to submit the UDBE Commitment form unless the Department requests it. If the Department requests you to submit a UDBE Commitment form, submit the completed form within 4 business days of the request.

Submit written confirmation from each UDBE stating that it is participating in the contract. Include confirmation with the UDBE Commitment form. A copy of a UDBE's quote will serve as written confirmation that the UDBE is participating in the contract.

If you do not submit the UDBE Commitment form within the specified time, the Department finds your bid nonresponsive.

### **Good Faith Efforts Submittal**

If you have not met the UDBE goal, complete and submit the Good Faith Efforts Documentation form with the bid showing that you made adequate good faith efforts to meet the goal. Only good faith efforts directed towards obtaining participation by UDBEs will be considered. If good faith efforts documentation is not submitted with the bid, it must be received by the Department no later than 4:00 p.m. on the 4th business day after bid opening.

If your UDBE Commitment form shows that you have met the UDBE goal or if you are required to submit the UDBE Commitment form, you must also submit good faith efforts documentation within the specified time to protect your eligibility for award of the contract in the event the Department finds that the UDBE goal has not been met.

Good faith efforts documentation must include the following information and supporting documents, as necessary:

1. Items of work you have made available to UDBE firms. Identify those items of work you might otherwise perform with its own forces and those items that have been broken down into economically feasible units to facilitate UDBE participation. For each item listed, show the dollar value and percentage of the total contract. It is your responsibility to demonstrate that sufficient work to meet the goal was made available to UDBE firms.
2. Names of certified UDBEs and dates on which they were solicited to bid on the project. Include the items of work offered. Describe the methods used for following up initial solicitations to determine with certainty if the UDBEs were interested, and the dates of the follow-up. Attach supporting documents such as copies of letters, memos, facsimiles sent, telephone logs, telephone billing statements, and other evidence of solicitation. You are reminded to solicit certified UDBEs through all reasonable and available means and provide sufficient time to allow UDBEs to respond.
3. Name of selected firm and its status as a UDBE for each item of work made available. Include name, address, and telephone number of each UDBE that provided a quote and their price quote. If the firm selected for the item is not a UDBE, provide the reasons for the selection.
4. Name and date of each publication in which you requested UDBE participation for the project. Attach copies of the published advertisements.
5. Names of agencies and dates on which they were contacted to provide assistance in contacting, recruiting, and using UDBE firms. If the agencies were contacted in writing, provide copies of supporting documents.
6. List of efforts made to provide interested UDBEs with adequate information about the plans, specifications, and requirements of the contract to assist them in responding to a solicitation. If you have provided information, identify the name of the UDBE assisted, the nature of the information provided, and date of contact. Provide copies of supporting documents, as appropriate.
7. List of efforts made to assist interested UDBEs in obtaining bonding, lines of credit, insurance, necessary equipment, supplies, and materials, excluding supplies and equipment that the UDBE subcontractor purchases or leases from the prime contractor or its affiliate. If such assistance is provided by you, identify the name of the UDBE assisted, nature of the assistance offered, and date. Provide copies of supporting documents, as appropriate.
8. Any additional data to support demonstration of good faith efforts.

The Department may consider UDBE commitments of the 2nd and 3rd bidders when determining whether the low bidder made good faith efforts to meet the UDBE goal.

### **2-1.03 SSPC QP CERTIFICATION PREAWARD QUALIFICATION**

Submit the SSPC QP certification required for cleaning and painting in these special provisions.

If you do not submit the certification with your bid, submit it so that it is received by the Office Engineer no later than 4:00 p.m. on the 2nd business day after bid opening.

If you do not submit the certification within the specified time, the Department finds your bid nonresponsive.

## **2-1.04 OPT OUT OF PAYMENT ADJUSTMENTS FOR PRICE INDEX FLUCTUATIONS**

You may opt out of the payment adjustments for price index fluctuations as specified in "Payment Adjustments for Price Index Fluctuations" of these special provisions. If you elect to opt out of the provisions of this specification, you must complete the "Opt Out of Payment Adjustments for Price Index Fluctuations" form. The completed form must be submitted with your bid.

## **SECTION 3 CONTRACT AWARD AND EXECUTION**

### **3-1.01 SMALL BUSINESS PARTICIPATION REPORT**

The Department has established an overall 25 percent small business participation goal. To determine if the goal is achieved, the Department is tracking small business participation on all contracts.

Complete and sign the Small Business (SB) Participation Report form included in the contract documents even if no small business participation is reported. Submit it with the executed contract.

### **3-1.02 CALTRANS BIDDER - DBE INFORMATION FORM**

Complete and sign the Caltrans Bidder - DBE Information form included in the contract documents even if no DBE participation is reported. Submit it with the executed contract.

Provide written confirmation from each DBE that the DBE is participating in the contract. A copy of a DBE's quote serves as written confirmation. If a DBE is participating as a joint venture partner, the Department encourages you to submit a copy of the joint venture agreement.

## **SECTION 4. BEGINNING OF WORK, TIME OF COMPLETION, AND LIQUIDATED DAMAGES**

The 1st working day is the 55th day after contract approval.

Do not start work at the job site until the Engineer approves your submittal for:

1. Baseline Progress Schedule (Critical Path Method)
2. Storm Water Pollution Prevention Plan (SWPPP)
3. Notification of Dispute Resolution Advisor (DRA) or Dispute Review Board (DRB) nominee and disclosure statement as specified in Section 5-1.15, "Dispute Resolution," of the Standard Specifications

You may enter the job site only to measure controlling field dimensions and locating utilities. Do not start other work activities until all the submittals from the above list are approved and the following information is submitted:

1. Notice of Materials To Be Used.
2. Contingency plan for reopening closures to public traffic.
3. Written statement from the vendor that the order for the sign panels has been received and accepted by the vendor. The statement must show the dates that the materials will be shipped.
4. Written statement from the vendor that the order for electrical material has been received and accepted by the vendor. The statement must show the dates that the materials will be shipped.
5. Written statement from the vendor that the order for structural steel has been received and accepted by the vendor. The statement must show the dates that the materials will be shipped.

You may start work at the job site before the 55th day after contract approval if:

1. You obtain required approval for each submittal before the 55th day
2. The Engineer authorizes it in writing

The Department grants a time extension if a delay is beyond your control and prevents you from starting work at the job site on the 1st working day.

Complete the work, except plant establishment work, within 720 working days.

Complete the work, including plant establishment work, within 900 working days.

## SECTION 5 GENERAL

### 5-1.01 EMISSIONS REDUCTION

Contract execution constitutes submittal of the following certification:

I am aware of the emissions reduction regulations being mandated by the California Air Resources Board. I will comply with such regulations before commencing the performance of the work and maintain compliance throughout the duration of this contract.

### 5-1.02 PERFORMANCE OF DBEs

Use each DBE subcontractor as listed on the Subcontractor List form unless you receive authorization for a substitution. The Department requests the Contractor to:

1. Notify the Engineer of any changes to its anticipated DBE participation
2. Provide this notification before starting the affected work

Maintain records including:

1. Name and business address of each 1st-tier subcontractor
2. Name and business address of each DBE subcontractor, DBE vendor, and DBE trucking company, regardless of tier
3. Date of payment and total amount paid to each business

If you are a DBE contractor, include the date of work performed by your own forces and the corresponding value of the work.

Before the 15th of each month, submit a Monthly DBE Trucking Verification form.

If a DBE subcontractor is decertified before completing subcontracted work, the subcontractor must notify you in writing of the decertification date. If a subcontractor becomes a certified DBE before completing subcontracted work, the subcontractor must notify you in writing of the certification date. Submit the notifications. On contract work completion, complete a Disadvantaged Business Enterprises (DBE) Certification Status Change form. Submit the form within 90 days of contract acceptance.

Upon contract work completion, complete a Final Report – Utilization of Disadvantaged Business Enterprises (DBE), First-Tier Subcontractors form. Submit it within 90 days of contract acceptance. The Department withholds \$10,000 until the form is submitted. The Department releases the withhold upon submission of the completed form.

### 5-1.03 PERFORMANCE OF UDBEs

UDBEs must perform work or supply materials as listed in the Caltrans Bidder - UDBE - Commitment form specified under Section 2, "Bidding," of these special provisions. Do not terminate a UDBE listed subcontractor for convenience and perform the work with your own forces or obtain materials from other sources without prior written authorization from the Department.

The Department grants authorization to use other forces or sources of materials for requests that show any of the following justifications:

1. Listed UDBE fails or refuses to execute a written contract based on plans and specifications for the project.
2. You stipulated that a bond is a condition of executing the subcontract and the listed UDBE fails to meet your bond requirements.
3. Work requires a contractor's license and listed UDBE does not have a valid license under Contractors License Law.
4. Listed UDBE fails or refuses to perform the work or furnish the listed materials.
5. Listed UDBE's work is unsatisfactory and not in compliance with the contract.
6. Listed UDBE delays or disrupts the progress of the work.
7. Listed UDBE becomes bankrupt or insolvent.

If a listed UDBE subcontractor is terminated, you must make good faith efforts to find another UDBE subcontractor to substitute for the original UDBE. The substitute UDBE must perform at least the same amount of work as the original UDBE under the contract to the extent needed to meet the UDBE goal.

The substitute UDBE must be certified as a DBE at the time of request for substitution.

The Department does not pay for work or material unless it is performed or supplied by the listed UDBE or an authorized substitute.

#### **5-1.04 PARTNERING DISPUTE RESOLUTION**

The Department encourages the project team to exhaust the use of partnering in dispute resolution before engagement of an objective third party. Comply with Section 5-1.012, "Partnering," of the Standard Specifications.

For certain disputes, facilitated partnering session or facilitated dispute resolution session may be appropriate and effective in clarifying issues and resolving all or part of a dispute.

To afford the project team enough time to plan and hold the session, a maximum of 20 days may be added to the dispute resolution board (DRB) referral time following the Engineer's written response to a supplemental potential claim record as specified in Section 5-1.15, "Dispute Resolution," of the Standard Specifications.

To allow this additional referral time, the project team must document its agreement and intention in the dispute resolution plan of the partnering charter. The team may further document agreement of any associated criteria to be met for use of the additional referral time.

If the session is not held, the DRB referral time remains in effect as specified in Section 5-1.15, "Dispute Resolution," of the Standard Specifications.

#### **5-1.05 PAYMENT ADJUSTMENTS FOR PRICE INDEX FLUCTUATIONS**

##### **GENERAL**

##### **Summary**

This section applies to asphalt contained in materials for pavement structural sections and pavement surface treatments such as hot mix asphalt (HMA), tack coat, asphaltic emulsions, bituminous seals, asphalt binders, and modified asphalt binders placed in the work. This section does not apply if you opted out of payment adjustment for price index fluctuations at the time of bid.

The Engineer adjusts payment if the California Statewide Crude Oil Price Index for the month the material is placed is more than 5 percent higher or lower than the price index at the time of bid.

The California Statewide Crude Oil Price Index is determined each month on or about the 1st business day of the month by the Department using the average of the posted prices in effect for the previous month as posted by Chevron, ExxonMobil, and ConocoPhillips for the Buena Vista, Huntington Beach, and Midway Sunset fields.

If a company discontinues posting its prices for a field, the Department determines the index from the remaining posted prices. The Department may include additional fields to determine the index.

For the California Statewide Crude Oil Price Index, go to:

<http://www.dot.ca.gov/hq/construc/crudeoilindex/>

If the adjustment is a decrease in payment, the Department deducts the amount from the monthly progress payment.

The Department includes payment adjustments for price index fluctuations when making adjustments under Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications.

If you do not complete the work within the contract time, payment adjustments during the overrun period are determined using the California Statewide Crude Oil Price Index in effect for the month in which the overrun period began.

If the price index at the time of placement increases:

1. 50 percent or more over the price index at bid opening, notify the Engineer.
2. 100 percent or more over the price index at bid opening, do not furnish material containing asphalt until the Engineer authorizes you to proceed with that work. The Department may decrease Bid item quantities, eliminate Bid items, or terminate the contract.

##### **Submittals**

Before placing material containing asphalt, submit the current sales and use tax rate in effect in the tax jurisdiction where the material is to be placed.

Submit certified weight slips for HMA, tack coat, asphaltic emulsions, and modified asphalt binders, including those materials not paid for by weight, as specified in Section 9-1.01, "Measurement of Quantities," of the Standard Specifications. For slurry seals, submit certified weight slips separately for the asphaltic emulsion.

#### **ASPHALT QUANTITIES**

##### **General**

Interpret the term "ton" as "tonne" for projects using metric units.

### Hot Mix Asphalt

The Engineer calculates the quantity of asphalt in HMA using the following formula:

$$Q_h = HMATT \times [X_a / (100 + X_a)]$$

where:

$Q_h$  = quantity in tons of asphalt used in HMA  
 $HMATT$  = HMA total tons placed  
 $X_a$  = theoretical asphalt content from job mix formula expressed as percentage of the weight of dry aggregate

### Rubberized Hot Mix Asphalt

The Engineer calculates the quantity of asphalt in rubberized HMA (RHMA) using the following formula:

$$Q_{rh} = RHMATT \times 0.80 \times [X_{arb} / (100 + X_{arb})]$$

where:

$Q_{rh}$  = quantity in tons of asphalt in asphalt rubber binder used in RHMA  
 $RHMATT$  = RHMA total tons placed  
 $X_{arb}$  = theoretical asphalt rubber binder content from the job mix formula expressed as percentage of the weight of dry aggregate

### Modified Asphalt Binder in Hot Mix Asphalt

The Engineer calculates the quantity of asphalt in modified asphalt binder using the following formula:

$$Q_{mh} = MHMATT \times [(100 - X_{am}) / 100] \times [X_{mab} / (100 + X_{mab})]$$

where:

$Q_{mh}$  = quantity in tons of asphalt in modified asphalt binder used in HMA  
 $MHMATT$  = modified asphalt binder HMA total tons placed  
 $X_{am}$  = specified percentage of asphalt modifier  
 $X_{mab}$  = theoretical modified asphalt binder content from the job mix formula expressed as percentage of the weight of dry aggregate

### Hot Mix Asphalt Containing Reclaimed Asphalt Pavement (RAP)

The Engineer calculates the quantity of asphalt in HMA containing RAP using the following formulas:

$$Q_{rap} = HMATT \times [X_{aa} / (100 + X_{aa})]$$

where:

$$X_{aa} = X_{ta} - [(100 - X_{new}) \times (X_{ra} / 100)]$$

and

$Q_{rap}$  = quantity in tons of asphalt used in HMA containing RAP  
 $HMATT$  = HMA total tons placed  
 $X_{aa}$  = asphalt content of HMA adjusted to account for the asphalt content in RAP expressed as percentage of the weight of dry aggregate  
 $X_{ta}$  = total asphalt content of HMA expressed as percentage of the weight of dry aggregate  
 $X_{new}$  = theoretical percentage of new aggregate in the HMA containing RAP determined from RAP percentage in the job mix formula  
 $X_{ra}$  = asphalt content of RAP expressed as percentage

### Tack Coat

The Engineer calculates the quantity of asphalt in tack coat ( $Q_{tc}$ ) as either:

1. Asphalt binder using the asphalt binder total tons placed as tack coat
2. Asphaltic emulsion by applying the formula in "Asphaltic Emulsion" to the asphaltic emulsion total tons placed as tack coat

### **Asphaltic Emulsion**

The Engineer calculates the quantity of asphalt in asphaltic emulsions, including fog seals and tack coat, using the following formula:

$$Q_e = AETT \times (X_e / 100)$$

where:

- Q<sub>e</sub> = quantity in tons of asphalt used in asphaltic emulsions
- AETT = undiluted asphaltic emulsions total tons placed
- X<sub>e</sub> = minimum percent residue specified in Section 94, "Asphaltic Emulsions," of the Standard Specifications based on the type of emulsion used

You may, as an option, determine "X<sub>e</sub>" by submitting actual daily test results for asphalt residue for the asphaltic emulsion used. If you choose this option, you must:

1. Take 1 sample every 200 tons but not less than 1 sample per day in the presence of the Engineer from the delivery truck, at midload from a sampling tap or thief, and in the following order:
  - 1.1. Draw and discard the 1st gallon
  - 1.2. Take two separate 1/2-gallon samples
2. Submit 1st sample at the time of sampling
3. Provide 2nd sample within 3 business days of sampling to an independent testing laboratory that participates in the AASHTO Proficiency Sample Program
4. Submit test results from independent testing laboratory within 10 business days of sample date

### **Slurry Seal**

The Engineer calculates the quantity of asphalt in slurry seals (Q<sub>ss</sub>) by applying the formula in "Asphaltic Emulsion" to the actual quantity of asphaltic emulsion used in producing the slurry seal mix.

### **Modified Asphalt Binder**

The Engineer calculates the quantity of asphalt in modified asphalt binder using the following formula:

$$Q_{mab} = MABTT \times [(100 - X_{am}) / 100]$$

where:

- Q<sub>mab</sub> = quantity in tons of asphalt used in modified asphalt binder
- MABTT = modified asphalt binder total tons placed
- X<sub>am</sub> = specified percentage of asphalt modifier

### **Other Materials**

For other materials containing asphalt not covered above, the Engineer determines the quantity of asphalt (Q<sub>o</sub>).

### **PAYMENT ADJUSTMENTS**

The Engineer includes payment adjustments for price index fluctuations in progress pay estimates. If material containing asphalt is placed within 2 months during 1 estimate period, the Engineer calculates 2 separate adjustments. Each adjustment is calculated using the price index for the month in which the quantity of material containing asphalt subject to adjustment is placed in the work. The sum of the 2 adjustments is used for increasing or decreasing payment in the progress pay estimate.

The Engineer calculates each payment adjustment as follows:

$$PA = Q_t \times A$$

where:

PA = Payment adjustment in dollars for asphalt contained in materials placed in the work for a given month.

Q<sub>t</sub> = Sum of quantities of asphalt (Q<sub>h</sub> + Q<sub>rh</sub> + Q<sub>mh</sub> + Q<sub>rap</sub> + Q<sub>tc</sub> + Q<sub>e</sub> + Q<sub>ss</sub> + Q<sub>mab</sub> + Q<sub>o</sub>).

A = Adjustment in dollars per ton of asphalt used to produce materials placed in the work rounded to the nearest \$0.01.

For US Customary projects, use:

$$A = [(I_u / I_b) - 1.05] \times I_b \times [1 + (T / 100)] \text{ for an increase in the crude oil price index exceeding 5 percent}$$
$$A = [(I_u / I_b) - 0.95] \times I_b \times [1 + (T / 100)] \text{ for a decrease in the crude oil price index exceeding 5 percent}$$

For metric projects, use:

$$A = 1.1023 \times [(I_u / I_b) - 1.05] \times I_b \times [1 + (T / 100)] \text{ for an increase in the crude oil price index exceeding 5 percent}$$
$$A = 1.1023 \times [(I_u / I_b) - 0.95] \times I_b \times [1 + (T / 100)] \text{ for a decrease in the crude oil price index exceeding 5 percent}$$

$I_u$  = California Statewide Crude Oil Price Index for the month in which the quantity of asphalt subject to adjustment was placed in the work.

$I_b$  = California Statewide Crude Oil Price Index for the month in which the bid opening for the project occurred

$T$  = Sales and use tax rate, expressed as a percent, currently in effect in the tax jurisdiction where the material is placed.

If the tax rate information is not submitted timely, the statewide sales and use tax rate is used in the payment adjustment calculations until the tax rate information is submitted.

### 5-1.06 SURFACE MINING AND RECLAMATION ACT

Imported borrow or aggregate material must come from a surface mine permitted under the Surface Mining and Reclamation Act of 1975 (SMARA), Pub Res Code § 2710, et seq., or from an exempt site.

The Department of Conservation, Office of Mine Reclamation maintains a list of permitted mine sites. For the list of permitted sites, go to:

[http://www.conservation.ca.gov/omr/ab\\_3098\\_list](http://www.conservation.ca.gov/omr/ab_3098_list)

If you import borrow or aggregate material from a surface mine not on this list, submit proof the mine is exempt from SMARA.

### 5-1.07 ELECTRONIC SUBMISSION OF PAYROLL RECORDS

In lieu of submitting weekly payroll records to the Engineer as specified in Section 7-1.01A(3), "Payroll Records," of the Standard Specifications, you may submit weekly payroll records electronically.

Before submitting payroll records electronically, you must complete and sign the Contractor's Acknowledgement and submit it to the District where your project is located. Submit your signed acknowledgement to the corresponding District electronic mailbox shown in the following table:

**Electronic Mailboxes**

District	Address
1	district1.payrolls@dot.ca.gov
2	district2.payrolls@dot.ca.gov
3	district3.payrolls@dot.ca.gov
4	district4.payrolls@dot.ca.gov
5	district5.payrolls@dot.ca.gov
6	district6.payrolls@dot.ca.gov
7	district7.payrolls@dot.ca.gov
8	district8.payrolls@dot.ca.gov
9	district9.payrolls@dot.ca.gov
10	district10.payrolls@dot.ca.gov
11	district11.payrolls@dot.ca.gov
12	district12.payrolls@dot.ca.gov

The Department responds with an e-mail containing a Caltrans Internet Certificate to be used for the electronic submission of payroll records. You must agree to accept this certificate and reply to the e-mail. After you accept the certificate and reply to the e-mail, the Department is ready to accept your electronic submissions.

Each electronic submission must:

1. Include payroll records in a nonmodifiable PDF image format. No spreadsheets, word documents, or password protected documents are accepted.
2. Include payroll records with all data elements required by the Labor Code § 1776.
3. Include a signed Statement of Compliance form with each weekly record.
4. Be received by the Department by close of business on the 15th day of the month for the prior month's work.
5. Be encrypted before submission.
6. Contain the following information in the subject line:
  - 6.1. Contract number
  - 6.2. Week ending date as W/E mm/dd/yy
7. Contain 1 contract number and week ending date per submission.

For additional information on electronic submission of payroll records, go to:

<http://www.dot.ca.gov/hq/construc/LaborCompliance/index.htm>

#### **5-1.08 TRAINING**

For the Federal training program, the number of trainees or apprentices is 58.

#### **5-1.09 FORCE ACCOUNT PAYMENT**

Payment for extra work at force account will be determined by either non-subcontracted or subcontracted force account payment unless otherwise specified.

##### **Non-Subcontracted Force Account Payment**

When extra work to be paid for on a force account basis is performed by the Contractor, compensation will be determined as specified in Section 9-1.03, "Force Account Payment," of the Standard Specifications except for the markups. The markups specified in Section 9-1.03B, "Labor," Section 9-1.03C, "Materials," and Section 9-1.03D, "Equipment Rental" are changed to the following markups:

Cost	Percent Markup
Labor	30
Materials	10
Equipment Rental	10

The above markups shall be applied to work performed on a force account basis, regardless of whether the work revises the current contract completion date.

The above markups, together with payments made for time-related overhead under "Time-Related Overhead" of these special provisions, shall constitute full compensation for all overhead costs for work performed on a force account basis.

Full compensation for overhead costs for work performed on a force account basis, and for which no adjustment is made to the quantity for time-related overhead conforming to the provisions in "Time-Related Overhead" of these special provisions, shall be considered as included in the markups specified above, and no additional compensation will be allowed therefor.

##### **Subcontracted Force Account Payment**

When extra work to be paid for on a force account basis is performed by a subcontractor approved in conformance with the provisions in Section 5-1.055, "Subcontracting," of the Standard Specifications, compensation will be determined in accordance with the provisions in Section 9-1.03, "Force Account Payment," of the Standard Specifications.

#### **5-1.10 AREAS FOR CONTRACTOR'S USE**

Attention is directed to the provisions in Section 7-1.19, "Rights in Land and Improvements," of the Standard Specifications and these special provisions.

The highway right of way shall be used only for purposes that are necessary to perform the required work. The Contractor shall not occupy the right of way, or allow others to occupy the right of way, for purposes which are not necessary to perform the required work.

No State-owned parcels adjacent to the right of way are available for the exclusive use of the Contractor within the contract limits. The Contractor shall secure, at the Contractor's own expense, areas required for plant sites, storage of equipment or materials, or for other purposes.

No area is available within the contract limits for the exclusive use of the Contractor. However, temporary storage of equipment and materials on State property may be arranged with the Engineer, subject to the prior demands of State maintenance forces and to other contract requirements. Use of the Contractor's work areas and other State-owned property shall be at the Contractor's own risk, and the State shall not be held liable for damage to or loss of materials or equipment located within such areas.

#### **5-1.11 PAYMENTS**

In determining the partial payments to be made to the Contractor, only the following listed materials will be considered for inclusion in the payment as materials furnished but not incorporated in the work:

- A. Pavement dowels
- B. Piling except Cast-In-Drilled-Hole piling
- C. Precast Prestressed concrete member
- D. Sound wall (masonry block)
- E. Bar reinforcing steel
- F. Structural steel
- G. Metal sign structure
- H. Culvert pipe
- I. Miscellaneous drainage facilities
- J. Welded steel pipe
- K. Miscellaneous iron and steel
- L. Miscellaneous metal
- M. Type B Joint Seals
- N. Prestressing steel for cast-in-place members, sealed packages only, and prestressing ducts and anchorages
- O. Timber
- P. Miscellaneous bridge metal
- Q. Bridge deck drainage system
- R. Isolation casing
- S. Railing and appurtenances
- T. Lighting fixtures
- U. Luminaires
- V. Camera assemblies
- W. Splice vault
- X. Fiber optic cables and conduits
- Y. Innerducts
- Z. Tie bars and basket
- AA. Underdrain pipe
- AB. Chain link railing
- AC. Crash Cushions
- AD. Pavement Markers

#### **5-1.12 SUPPLEMENTAL PROJECT INFORMATION**

The Department makes the following supplemental project information available:

**Supplemental Project Information**

Means	Description
Included in the Information Handout	1. Hydraulic Report 2. Foundation Report 3. Army Corps of Engineers 404 Permit 4. Regional Water Quality Control Board 401 Certification 5. Los Angeles County Flood Control Permit 6. California Department of Fish and Game Permit
Available for inspection at the District Office	1. Aerially Deposited Lead Site Investigation Report. Route 710 Improvement Project, Olympic Blvd. to Route I-10. 2. Aerially Deposited Lead Investigation Report from Los Angeles River Bridge to south of Olympic Blvd.
Available as specified in the Standard Specifications	Bridge as-built drawings
Available at: <a href="http://www.dot.ca.gov/hq/esc/oe/weekly_ads/index.php">http://www.dot.ca.gov/hq/esc/oe/weekly_ads/index.php</a>	Cross sections

**5-1.13 NOISE CONTROL**

**General**

This section applies to equipment on the project or associated with the project, including trucks, transit mixers, stationary equipment, and transient equipment.

The noise level from Contractor's operations should not exceed 86 dBA at 50 feet from the project limits from 7 p.m. to 7 a.m. at bridge locations adjacent to residential homes. This includes Los Angeles River Bridge (53-0828), Olympic Boulevard Undercrossing (53-1044) and Whittier Boulevard Bridge (53-1150).

This requirement shall not relieve the Contractor from responsibility for complying with local ordinances regulating noise level.

The noise requirement shall apply to the equipment on the job or related to the job, including but not limited to trucks, transit mixers or transient equipment that may or may not be owned by the Contractor.

Full compensation for conforming to the requirements of this section shall be considered as included in the prices paid for various contract items of work involved and no additional compensation will be allowed therefor.

**Noise Monitoring**

Provide 1 Type 1 sound level meter and 1 acoustic calibrator to be used by the Department until contract acceptance. Provide training by a person trained in noise monitoring to 1 Department employee designated by the Engineer. The sound level meter must be calibrated and certified by the manufacturer or other independent acoustical laboratory before delivery to the Department. Provide annual recalibration by the manufacturer or other independent acoustical laboratory. The sound level meter must be capable of taking measurements using the A-weighting network and the slow response settings. The measurement microphone must be fitted with a windscreen. The Department returns the equipment to you at contract acceptance.

The contract lump sum price paid for noise monitoring includes full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all work involved in noise monitoring.

**5-1.14 BIRD PROTECTION**

The Department anticipates nesting or attempted nesting by migratory and nongame birds from February 15th to September 1st.

Stop all work within a 100-foot radius of the discovery except as specified in the following table:

**Radii Exceptions**

Species	Work stoppage radii (feet)
Songbirds	150
Raptors	500

### **5-1.15 RELATIONS WITH CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD**

This project lies within the boundaries of the Los Angeles Regional Water Quality Control Board (RWQCB).

The State Water Resources Control Board (SWRCB) has issued to the Department a permit that governs storm water and non-storm water discharges from the Department's properties, facilities, and activities. The Department's permit is entitled "Order No. 99 - 06 - DWQ, NPDES No. CAS000003, National Pollutant Discharge Elimination System (NPDES) Permit, Statewide Storm Water Permit and Waste Discharge Requirements (WDRs) for the State of California, Department of Transportation (Caltrans)." Copies of the Department's permit are available for review from the SWRCB, Division of Water Quality, 1001 "I" Street, P.O. Box 100, Sacramento, California 95812-0100, Telephone fax: (916) 341-5463 and may also be obtained at:

[http://www.waterboards.ca.gov/water\\_issues/programs/stormwater/caltrans.shtml](http://www.waterboards.ca.gov/water_issues/programs/stormwater/caltrans.shtml)

The Department's permit references and incorporates by reference the current statewide general permit issued by the SWRCB entitled "Order No. 2009-0009-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002, Waste Discharge Requirements for Discharges of Storm Water Runoff Associated with Construction and Land Disturbance Activities" that regulates discharges of storm water and non-storm water from construction activities disturbing one acre or more of soil in a common plan of development. Copies of the statewide permit and modifications thereto are available for review from the SWRCB, Division of Water Quality, 1001 "I" Street, P.O. Box 100, Sacramento, California 95812-0100, Telephone fax: (916) 341-5463 and may also be obtained at:

[http://www.waterboards.ca.gov/water\\_issues/programs/stormwater/](http://www.waterboards.ca.gov/water_issues/programs/stormwater/)

The NPDES permits that regulate this project, as referenced above, are collectively referred to in this section as the "permits."

This project shall conform to the permits and modifications thereto. The Contractor shall maintain copies of the permits at the project site and shall make them available during construction.

The Contractor shall know and comply with provisions of Federal, State, and local regulations and requirements that govern the Contractor's operations and storm water and non-storm water discharges from the project site and areas of disturbance outside the project limits during construction. Attention is directed to Sections 7-1.01, "Laws to be Observed," 5-1.18, "Property and Facility Preservation," 7-1.12, "Indemnification and Insurance," and 9-1.07E(5), "Penalty Withholds," of the Standard Specifications.

The Contractor shall notify the Engineer immediately upon request from the regulatory agencies to enter, inspect, sample, monitor, or otherwise access the project site or the Contractor's records pertaining to water pollution control work. The Contractor and the Department shall provide copies of correspondence, notices of violation, enforcement actions, or proposed fines by regulatory agencies to the requesting regulatory agency.

### **5-1.16 MATERIAL SITES**

Local material sites used by the Contractor shall be graded so that, at the time of final inspection of the contract, the sites will drain and will blend in with the surrounding terrain.

### **5-1.17 AERIALY DEPOSITED LEAD**

Aerially deposited lead is present within the project limits. Aerially deposited lead is lead deposited within unpaved areas or formerly unpaved areas, primarily due to vehicle emissions.

Attention is directed to "Material Containing Hazardous Waste Concentrations of Aerially Deposited Lead" and "Project Information" of these special provisions.

Portions of the site investigation report are included in the "Material Information" handout. The complete report, entitled "Aerially Deposited Lead Site Investigation Report, Route 710 Improvement Project, Olympic Boulevard to Route 10, PM 23.4/26.5, Los Angeles County, California, Contract No. 07A2212, EA No. 07-202101, Task Order No. 14, prepared by WorleyParsons, March 5, 2010" and "Aerially Deposited Lead Investigation Report from Los Angeles River Bridge to South of Olympic Boulevard, 07-LA-710 PM 17.2/23.4, Los Angeles County, California, Contract No. 07A2730, Task Order No. 1, EA No. 07-202101, prepared by AMEC Geomatrix, Inc. July 19, 2010," is available for inspection at the Department of Transportation, Division of Construction, CCO Desk, 100 South Main Street, Suite 300, Los Angeles, CA 90012.

The Department has received from the California Department of Toxic Substances Control (DTSC) a Variance regarding the use of material containing aerially deposited lead. This project is subject to the conditions of the Variance, as amended. The Variance is available for inspection at the Department of Transportation, District 7, Division of Construction, CCO Desk, 100 South Main Street, Suite 300, Los Angeles, CA 90012.

Once the Contractor has completed the placement of material containing aurally deposited lead in conformance with these special provisions and as directed by the Engineer, the Contractor shall have no responsibility for such materials. The Department will not consider the Contractor a generator of such contaminated materials.

Excavation, reuse, and disposal of material with aurally deposited lead shall be in conformance with all rules and regulations including, but not limited to, those of the following agencies:

- A. United States Department of Transportation,
- B. United States Environmental Protection Agency,
- C. California Environmental Protection Agency,
- D. California Department of Health Services,
- E. Department of Toxic Substances Control,
- F. California Division of Occupational Safety and Health Administration,
- G. Integrated Waste Management Board,
- H. Regional Water Quality Control Board, Region 4, Los Angeles,
- I. State Air Resources Control Board, and
- J. South Coast Air Quality Management District.

Materials containing hazardous levels of lead shall be transported and disposed of in conformance with Federal and State laws and regulations, as amended, and county and municipal ordinances and regulations, as amended. Laws and regulations that govern this work include, but are not limited to:

- A. Health and Safety Code, Division 20, Chapter 6.5 (California Hazardous Waste Control Act),
- B. Title 22, California Code of Regulations, Division 4.5 (Environmental Health Standards for the Management of Hazardous Waste), and
- C. Title 8, California Code of Regulations.

**5-1.18 NONHIGHWAY FACILITIES (INCLUDING UTILITIES)**

The utility owner will relocate a utility shown in the following table before the corresponding date shown:

<b>Utility Relocation and Date of the Relocation</b>		
Utility	Location	Date
10" water line (California Water Service)	Approximately.. Station 1238 +.(SE. Route 710/Olympic. Blvd)	To be relocated during construction
Streetlight poles (City of Vernon)	Approximately.. Station 1161 +.(SE. Route 710/Bandini. Blvd)	07/15/2011
Underground Cable TV (Time Warner Cable)	Approximately.. Station 1331 +.(SE. Route 710/Floral. Drive)	07/15/2011
Underground Cable TV (AT&T)	Approximately.. Station 1157 +.(SE.Route710/ Atlantic Blvd)	10/15/2011

Utility Contact List (December 2010)

Company	Telephone
AT&T California	(626)308-4994 (626)308-4072
AT&T Long Distance	(714)963-7964
Verizon Business (MCI)	(626)666-3526
California Water Service	(323)722-8601
SCE (Southern California Edison)	(714)895-0331 (310)608-5153
County Sanitation District	(562)699-7411
City of Vernon	(323)583-8811
CTC(California Transport Commission)	(916)654-4245
Chevron	(714)228-1503
SCG(Southern California Gas Distribution)	(818)701-3448
Exxon Mobil Oil Corporation	(310)212-1761
Level 3 Communications	(720)888-7568
MCI	(972)729-6322
Charter Communication	(626)430-3335
Time Warner Cable	(626)855-3349
MWD(Metropolitan Water District of Southern California)	(323)276-7623
Plains All American Pipeline, LP	(562)728-2368
Park Water	(562)923-0711
QWEST	(714)666-9219 (949)981-4755
Sprint	(951)662-6262

To allow pile driving, drilling activities, or subsurface construction, the utility owner will rearrange the utilities shown in the following table during construction activities. No other utility will be rearranged or temporarily deactivated before or during construction activities for this purpose unless you make arrangements with the utility owner. Notify the Engineer at least 30 days before the interfering utilities are to be rearranged. The Engineer notifies the utility owners.

**Utility Rearrangement for Pile Driving, Drilling Activities, or Subsurface Construction**

Utility	Location
California Water Service	12" CI water line (estimated 100 ft) located station 1238+, SE E Olympic blvd and northbound I-710. (Abutment 1).. Per District Utility Maps.
AT&T	Underground Cable (estimated 220ft) located station 1157+SE Route 710/ Atlantic Blvd. Per District Utility Maps.

**5-1.19 DAMAGE REPAIR**

Attention is directed to Section 7-1.16, "Contractor's Responsibility for the Work and Materials," and Section 7-1.165, "Damage by Storm, Flood, Tsunami or Earthquake," of the Standard Specifications and these special provisions.

When as a result of freezing conditions (as defined herein) during the plant establishment period, plants have died or, in the opinion of the Engineer, have deteriorated to a point beyond which the plants will not mature as typical examples of their species, the Engineer may direct replacement of the affected plants. The total cost of ordered plant replacement work will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications. A freezing condition, for the purpose of this specification, occurs when the temperature at or near the affected area has been officially recorded below 32° F and plants have been killed or damaged to the degree described above.

When, as a result of drought conditions (as defined herein) during the plant establishment period, plants have died or, in the opinion of the Engineer, have deteriorated to a point beyond which the plants will not mature as typical examples of their species, the Engineer may direct replacement of the affected plants. The total cost of ordered plant replacements, after water has been restricted or stopped, will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications. Restriction or shutoff of available water shall not relieve the Contractor from performing other contract work. A drought condition occurs when the Department, or its supplier, restricts or stops delivery of water to the Contractor to the degree that plants have died or deteriorated as described above.

When the provisions in Section 7-1.165, "Damage by Storm, Flood, Tsunami or Earthquake," of the Standard Specifications are applicable, the provisions above for payment of costs for repair of damage due to rain, freezing conditions and drought shall not apply.

#### **5-1.20 RELIEF FROM MAINTENANCE AND RESPONSIBILITY**

The Contractor may be relieved of the duty of maintenance and protection for those items not directly connected with plant establishment work in conformance with the provisions in Section 7-1.15, "Relief From Maintenance and Responsibility," of the Standard Specifications. Water pollution control, maintain existing planted areas, maintain existing irrigation facilities, transplant trees, and transplant palm trees shall not be relieved of maintenance.

#### **SECTION 6. (BLANK)**

#### **SECTION 7. (BLANK)**

#### **SECTION 8. MATERIALS**

#### **SECTION 8-1. MISCELLANEOUS**

#### **8-1.01 PREQUALIFIED AND TESTED SIGNING AND DELINEATION MATERIALS**

The Department maintains the following list of Prequalified and Tested Signing and Delineation Materials. The Engineer shall not be precluded from sampling and testing products on the list of Prequalified and Tested Signing and Delineation Materials.

The manufacturer of products on the list of Prequalified and Tested Signing and Delineation Materials shall furnish the Engineer a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each type of traffic product supplied.

For those categories of materials included on the list of Prequalified and Tested Signing and Delineation Materials, only those products shown within the listing may be used in the work. Other categories of products, not included on the list of Prequalified and Tested Signing and Delineation Materials, may be used in the work provided they conform to the requirements of the Standard Specifications.

Materials and products may be added to the list of Prequalified and Tested Signing and Delineation Materials if the manufacturer submits a New Product Information Form to the New Product Coordinator at the Transportation Laboratory. Upon a Departmental request for samples, sufficient samples shall be submitted to permit performance of required tests. Approval of materials or products will depend upon compliance with the specifications and tests the Department may elect to perform.

#### **PAVEMENT MARKERS, PERMANENT TYPE**

##### **Retroreflective With Abrasion Resistant Surface (ARS)**

1. Apex, Model 921AR (4" x 4")
2. Ennis Paint, Models C88 (4" x 4"), 911 (4" x 4") and C80FH
3. Ray-O-Lite, Models "AA" ARC II (4" x 4") and ARC Round Shoulder (4" x 4")
4. 3M Series 290 (3.5" x 4")
5. 3M Series 290 PSA
6. Glowlite, Inc Model 988AR (4" x 4")

##### **Retroreflective With Abrasion Resistant Surface (ARS)**

(for recessed applications only)

1. Ennis Paint, Model 948 (2.3" x 4.7")
2. Ennis Paint, Model 944SB (2" x 4")\*
3. Ray-O-Lite, Model 2002 (2" x 4.6")
4. Ray-O-Lite, Model 2004 (2" x 4")\*

\*For use only in 4.5 inch wide (older) recessed slots

##### **Non-Reflective, 4-inch Round**

1. Apex Universal (Ceramic)
2. Apex Universal, Models 929 (ABS) and 929PP (Polypropylene)
3. Glowlite, Inc. (Ceramic) and PP (Polypropylene)
4. Hi-Way Safety, Inc., Models P20-2000W and 2001Y (ABS)

5. Interstate Sales, "Diamond Back" (Polypropylene)
6. Novabrite Models Cdot (White) Cdot-y (Yellow), Ceramic
7. Novabrite Models Pdot-w (White) Pdot-y (Yellow), Polypropylene
8. Three D Traffic Works TD10000 (ABS), TD10500 (Polypropylene)
9. Ray-O-Lite, Ray-O-Dot (Polypropylene)

#### **PAVEMENT MARKERS, TEMPORARY TYPE**

##### **Temporary Markers For Long Term Day/Night Use (180 days or less)**

1. Vega Molded Products "Temporary Road Marker" (3" x 4")
2. Pexco LLC, Halftrack model 25, 26 and 35

##### **Temporary Markers For Short Term Day/Night Use (14 days or less)**

(For seal coat or chip seal applications, clear protective covers are required)

1. Apex Universal, Model 932
2. Pexco LLC, Models T.O.M., T.R.P.M., and "HH" (High Heat)
3. Hi-Way Safety, Inc., Model 1280/1281
4. Glowlite, Inc., Model 932

#### **STRIPING AND PAVEMENT MARKING MATERIAL**

##### **Permanent Traffic Striping and Pavement Marking Tape**

1. Advanced Traffic Marking, Series 300 and 400
2. Brite-Line, Series 1000
3. Brite-Line, "DeltaLine XRP"
4. Swarco Industries, "Director 35" (For transverse application only)
5. Swarco Industries, "Director 60"
6. 3M, "Stamark" Series 380 and 270 ES
7. 3M, "Stamark" Series 420 (For transverse application only)

##### **Temporary (Removable) Striping and Pavement Marking Tape (180 days or less)**

1. Advanced Traffic Marking, Series 200
2. Brite-Line, Series 100
3. Garlock Rubber Technologies, Series 2000
4. P.B. Laminations, Aztec, Grade 102
5. Swarco Industries, "Director-2"
6. Trelleborg Industries, R140 Series
7. 3M Series 620 "CR", and Series 780
8. 3M Series A145, Removable Black Line Mask  
(Black Tape: for use only on Hot mix asphalt surfaces)
9. Advanced Traffic Marking Black "Hide-A-Line"  
(Black Tape: for use only on Hot mix asphalt surfaces)
10. Brite-Line "BTR" Black Removable Tape  
(Black Tape: for use only on Hot mix asphalt surfaces)
11. Trelleborg Industries, RB-140  
(Black Tape: for use only on Hot mix asphalt surfaces)

##### **Preformed Thermoplastic (Heated in place)**

1. Flint Trading Inc., "Hot Tape"
2. Flint Trading Inc., "Premark Plus"
3. Ennis Paint Inc., "Flametape"

##### **Ceramic Surfacing Laminate, 6" x 6"**

1. Highway Ceramics, Inc.

#### **CLASS 1 DELINEATORS**

##### **One Piece Driveable Flexible Type, 66-inch**

1. Pexco LLC, "Flexi-Guide Models 400 and 566"
2. Carsonite, Curve-Flex CFRM-400

3. Carsonite, Roadmarker CRM-375
4. FlexStake, Model 654 TM
5. GreenLine Model CGD1-66

**Special Use Type, 66-inch**

1. Pexco LLC, Model FG 560 (with 18-inch U-Channel base)
2. Carsonite, "Survivor" (with 18-inch U-Channel base)
3. Carsonite, Roadmarker CRM-375 (with 18-inch U-Channel base)
4. FlexStake, Model 604
5. GreenLine Model CGD (with 18-inch U-Channel base)
6. Impact Recovery Model D36, with #105 Driveable Base
7. Safe-Hit with 8-inch pavement anchor (SH248-GP1)
8. Safe-Hit with 15-inch soil anchor (SH248-GP2) and with 18-inch soil anchor (SH248-GP3)
9. Safe-Hit RT 360 Post with Soil Mount Anchor (GPS)
10. Shur-Tite Products, Shur-Flex Drivable

**Surface Mount Type, 48-inch**

1. Bent Manufacturing Company, Masterflex Model MFEX 180-48
2. Carsonite, "Channelizer"
3. FlexStake, Models 704, 754 TM, and EB4
4. Impact Recovery Model D48, with #101 Fixed (Surface-Mount) Base
5. Three D Traffic Works "Channelflex" ID No. 522248W
6. Flexible Marker Support, Flexistiff Model C-9484
7. Safe-Hit, SH 248 SMR

**CHANNELIZERS**

**Surface Mount Type, 36-inch**

1. Bent Manufacturing Company, Masterflex Models MF-360-36 (Round) MF-180-36 (Flat) and MFEX 180—36
2. Pexco LLC, Flexi-Guide Models FG300PE, FG300UR, and FG300EFX
3. Carsonite, "Super Duck" (Round SDR-336)
4. Carsonite, Model SDCF03601MB "Channelizer"
5. FlexStake, Models 703, 753 TM, and EB3
6. GreenLine, Model SMD-36
7. Hi-way Safety, Inc. "Channel Guide Channelizer" Model CGC36
8. Impact Recovery Model D36, with #101 Fixed (Surface-Mount) Base
9. Safe-Hit, Guide Post, Model SH236SMA and Dura-Post, Model SHL36SMA
10. Three D Traffic Works "Boomerang" 5200 Series
11. Flexible Marker Support, Flexistiff Model C-9484-36
12. Shur-Tite Products, Shur-Flex

**Lane Separation System**

1. Pexco LLC, "Flexi-Guide (FG) 300 Curb System"
2. Qwick Kurb, "Klemmfix Guide System"
3. Dura-Curb System
4. Tuff Curb
5. FG 300 Turnpike Curb

**CONICAL DELINEATORS, 42-inch**

(For 28-inch Traffic Cones, see Standard Specifications)

1. Bent Manufacturing Company "T-Top"
2. Plastic Safety Systems "Navigator-42"
3. TrafFix Devices "Grabber"
4. Three D Traffic Works "Ringtop" TD7000, ID No. 742143
5. Three D Traffic Works, TD7500
6. Work Area Protection Corp. C-42

## **OBJECT MARKERS**

### **Type "K", 18-inch**

1. Pexco LLC, Model FG318PE
2. Carsonite, Model SMD 615
3. FlexStake, Model 701 KM
4. Safe-Hit, Model SH718SMA

### **Type "Q" Object Markers, 24-inch**

1. Bent Manufacturing "Masterflex" Model MF-360-24
2. Pexco LLC, Model FG324PE
3. Carsonite, "Channelizer"
4. FlexStake, Model 701KM
5. Safe-Hit, Models SH824SMA\_WA and SH824GP3\_WA
6. Three D Traffic Works ID No. 531702W and TD 5200
7. Three D Traffic Works ID No. 520896W
8. Safe-Hit, Dura-Post SHLQ-24 inch

## **CONCRETE BARRIER MARKERS AND TEMPORARY RAILING (TYPE K) REFLECTORS**

### **Impactable Type**

1. ARTUK, "FB"
2. Pexco LLC, Models PCBM-12 and PCBM-T12
3. Duraflex Corp., "Flexx 2020" and "Electriflexx"
4. Hi-Way Safety, Inc., Model GMKRM100
5. Plastic Safety Systems "BAM" Models OM-BARR and OM-BWAR
6. Three D Traffic Works "Roadguide" Model TD 9300

### **Non-Impactable Type**

1. ARTUK, JD Series
2. Plastic Safety Systems "BAM" Models OM-BITARW and OM-BITARA
3. Vega Molded Products, Models GBM and JD
4. Plastic Vacuum Forming, "Cap-It C400"

## **METAL BEAM GUARD RAIL POST MARKERS**

(For use to the left of traffic)

1. Pexco LLC, "Mini" (3" x 10")
2. Creative Building Products, "Dura-Bull, Model 11201"
3. Duraflex Corp., "Railrider"
4. Plastic Vacuum Forming, "Cap-It C300"

## **CONCRETE BARRIER DELINEATORS, 16-inch**

(For use to the right of traffic)

1. Pexco LLC, Model PCBM T-16
2. Safe-Hit, Model SH216RBM
3. Three D Traffic Works "Roadguide" Model 9400

## **CONCRETE BARRIER-MOUNTED MINI-DRUM (10" x 14" x 22")**

1. Stinson Equipment Company "SaddleMarker"

## **GUARD RAILING DELINEATOR**

(Place top of reflective element at 48 inches above plane of roadway)

### **Wood Post Type, 27-inch**

1. Pexco LLC, FG 427 and FG 527
2. Carsonite, Model 427
3. FlexStake, Model 102 GR
4. GreenLine GRD 27

5. Safe-Hit, Model SH227GRD
6. Three D Traffic Works "Guardflex" TD9100
7. New Directions Mfg, NDM27
8. Shur-Tite Products, Shur-Tite Flat Mount

**Steel Post Type**

1. Carsonite, Model CFGR-327

**RETROREFLECTIVE SHEETING**

**Channelizers, Barrier Markers, and Delineators**

1. Avery Dennison T-6500 Series (For rigid substrate devices only)
2. Avery Dennison WR-7100 Series
3. Nippon Carbide Industries, Flexible Ultralite Grade (ULG) II
4. Reflexite, PC-1000 Metalized Polycarbonate
5. Reflexite, AC-1000 Acrylic
6. Reflexite, AP-1000 Metalized Polyester
7. Reflexite, Conformalight, AR-1000 Abrasion Resistant Coating
8. 3M, High Intensity

**Traffic Cones, 4-inch and 6-inch Sleeves**

1. Nippon Carbide Industries, Flexible Ultralite Grade (ULG) II
2. Reflexite, Vinyl, "TR" (Semi-transparent) or "Conformalight"
3. 3M Series 3840
4. Avery Dennison S-9000C

**Drums**

1. Avery Dennison WR-6100
2. Nippon Carbide Industries, Flexible Ultralite Grade (ULG) II
3. Reflexite, "Conformalight", "Super High Intensity" or "High Impact Drum Sheeting"
4. 3M Series 3810

**Barricades: Type I, Medium-Intensity (Typically Enclosed Lens, Glass-Bead Element)**

1. Nippon Carbide Industries, CN8117
2. Avery Dennison, W 1100 series
3. 3M Series CW 44

**Barricades: Type II, Medium-High-Intensity (Typically Enclosed Lens, Glass-Bead Element)**

1. Avery Dennison, W-2100 Series

**Vertical Clearance Signs: Structure Mounted**

1. 3M Model 4061, Diamond Grade DG3, Fluorescent Yellow

**Signs: Type II, Medium-High-Intensity (Typically Enclosed Lens, Glass-Bead Element)**

1. Avery Dennison, T-2500 Series
2. Nippon Carbide Industries, Nikkalite 18000

**Signs: Type III, High-Intensity (Typically Encapsulated Glass-Bead Element)**

1. Avery Dennison, T-5500A and T-6500 Series
2. Nippon Carbide Industries, Nikkalite Brand Ultralite Grade II
3. 3M 3870 and 3930 Series

**Signs: Type IV, High-Intensity (Typically Unmetallized Microprismatic Element)**

1. Avery Dennison, T-6500 Series
2. Nippon Carbide Industries, Crystal Grade, 94000 Series
3. Nippon Carbide Industries, Model No. 94847 Fluorescent Orange
4. 3M Series 3930 and Series 3924S

**Signs: Type VI, Elastomeric (Roll-Up) High-Intensity, without Adhesive**

1. Avery Dennison, WU-6014
2. Novabrite LLC, "Econobrite"
3. Reflexite "Vinyl"
4. Reflexite "SuperBright"
5. Reflexite "Marathon"
6. 3M Series RS20

**Signs: Type VII, Super-High-Intensity (Typically Unmetallized Microprismatic Element)**

1. 3M Series 3924S, Fluorescent Orange
2. 3M LDP Series 3970

**Signs: Type VIII, Super-High-Intensity (Typically Unmetallized Microprismatic Element)**

1. Avery Dennison, T-7500 Series
2. Avery Dennison, T-7511 Fluorescent Yellow
3. Avery Dennison, T-7513 Fluorescent Yellow Green
4. Avery Dennison, W-7514 Fluorescent Orange
5. Nippon Carbide Industries, Nikkalite Crystal Grade Series 92800
6. Nippon Carbide Industries, Nikkalite Crystal Grade Model 92847 Fluorescent Orange

**Signs: Type IX, Very-High-Intensity (Typically Unmetallized Microprismatic Element)**

1. 3M VIP Series 3981 Diamond Grade Fluorescent Yellow
2. 3M VIP Series 3983 Diamond Grade Fluorescent Yellow/Green
3. 3M VIP Series 3990 Diamond Grade
4. Avery Dennison T-9500 Series
5. Avery Dennison, T9513, Fluorescent Yellow Green
6. Avery Dennison, W9514, Fluorescent Orange
7. Avery Dennison, T-9511 Fluorescent Yellow

**SPECIALTY SIGNS**

1. Reflexite "Endurance" Work Zone Sign (with Semi-Rigid Plastic Substrate)

**ALTERNATIVE SIGN SUBSTRATES**

**Fiberglass Reinforced Plastic (FRP) and Expanded Foam PVC**

1. Fiber-Brite (FRP)
2. Sequentia, "Polyplate" (FRP)
3. Intoplast Group "InteCel" (0.5 inch for Post-Mounted CZ Signs, 48-inch or less)(PVC)

**Aluminum Composite, Temporary Construction Signs and Permanent Signs up to 4 foot, 7 Inches**

1. Alcan Composites "Dibond Material, 80 mils"
2. Mitsubishi Chemical America, Alpolic 350
3. Bone Safety Signs, Bone Light ACM (temporary construction signs only)

**8-1.02 STATE-FURNISHED MATERIALS**

The State furnishes you with:

Model 500 changeable message sign panels.

- Changeable message sign control cables.
- Model 170 controller assemblies for changeable message signs, ramp metering systems and traffic monitoring stations, including controller units, completely wired controller cabinets, and detector sensor units.
- Model 400 Modems.

The State furnishes you with completely wired controller cabinets with auxiliary equipment and controller units for ramp metering systems and traffic monitoring stations at the Department of Transportation, District Maintenance Yard, 7310 East Bandini Boulevard, Commerce, CA. 90040. At least 48 hours before you pick up the materials, inform the Engineer what you will pick up and when you will pick it up.

The State furnishes you with Model 500 changeable message signs, wiring harnesses, and controller assemblies, including the controller units and completely wired cabinets, at the Department of Transportation, District Maintenance Yard, 7310 East Bandini Boulevard, Commerce, CA. 90040. At least 48 hours before you pick up the materials, inform the Engineer what you will pick up and when you will pick it up.

### **8-1.03 SLAG AGGREGATE**

Air-cooled iron blast furnace slag shall not be used to produce aggregate for:

1. Structure backfill material.
2. Pervious backfill material.
3. Permeable material.
4. Reinforced or prestressed portland cement concrete component or structure.
5. Nonreinforced portland cement concrete component or structure for which a Class 1 Surface Finish is required by the provisions in Section 51-1.18B, "Class 1 Surface Finish," of the Standard Specifications.

Aggregate produced from slag resulting from a steel-making process shall not be used for a highway construction project except for the following items:

1. Imported Borrow.
2. Aggregate Subbase.
3. Class 2 Aggregate Base.
4. Hot Mix Asphalt.

Steel slag to be used to produce aggregate for aggregate subbase and Class 2 aggregate base shall be crushed so that 100 percent of the material will pass a 3/4-inch sieve and then shall be control aged for a period of at least 3 months under conditions that will maintain all portions of the stockpiled material at a moisture content in excess of 6 percent of the dry weight of the aggregate.

A supplier of steel slag aggregate shall provide separate stockpiles for controlled aging of the slag. An individual stockpile shall contain not less than 10,000 tons nor more than 50,000 tons of slag. The material in each individual stockpile shall be assigned a unique lot number and each stockpile shall be identified with a permanent system of signs. The supplier shall maintain a permanent record of the dates on which stockpiles are completed and controlled aging begun, of the dates when controlled aging was completed, and of the dates tests were made and the results of these tests. Moisture tests shall be made at least once each week. No credit for aging will be given for the time period covered by tests which show a moisture content of 6 percent or less. The stockpiles and records shall be available to the Engineer during normal working hours for inspection, check testing and review.

The supplier shall notify the Transportation Laboratory when each stockpile is completed and controlled aging begun. No more aggregate shall be added to the stockpile unless a new aging period is initiated. A further notification shall be sent when controlled aging is completed.

The supplier shall provide a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. Each stockpile or portion of a stockpile that is used in the work will be considered a lot. The Certificates of Compliance shall state that the steel slag aggregate has been aged in a stockpile for at least 3 months at a moisture content in excess of 6 percent of the dry weight of the aggregate.

Steel slag used for imported borrow shall be weathered for at least 3 months. Prior to the use of steel slag as imported borrow, the supplier shall furnish a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate of Compliance shall state that the steel slag has been weathered for at least 3 months.

Each delivery of aggregate containing steel slag for use as aggregate subbase or Class 2 aggregate base shall be accompanied by a delivery tag for each load which will identify the lot of material by stockpile number, where the slag was aged, and the date that the stockpile was completed and controlled aging begun.

Air-cooled iron blast furnace slag or natural aggregate may be blended in proper combinations with steel slag aggregate to produce the specified gradings, for those items for which steel slag aggregate is permitted, unless otherwise provided.

Aggregate containing slag shall meet the applicable quality requirements for the items in which the aggregate is used.

The combined slag aggregate shall conform to the specified grading for the item in which it is used. The grading will be determined by California Test 202, modified by California Test 105 when there is a difference in specific gravity of 0.2 or more between the coarse and fine portion of the aggregate or between blends of different aggregates.

No aggregate produced from slag shall be placed within one foot, measured in any direction, of a non-cathodically protected pipe or structure unless the aggregate is incorporated in portland cement concrete pavement, in hot mix asphalt, or in treated base.

When slag is used as aggregate in hot mix asphalt, the  $K_c$  factor requirements, as determined by California Test 303, will not apply.

Slag aggregate used for embankment construction shall not be placed within 18 inches of finished slope lines, measured normal to the plane of the slope.

If steel slag aggregates are used to make hot mix asphalt, there shall be no other aggregates used in the mixture, except that up to 50 percent of the material passing the No. 4 sieve may consist of iron blast furnace slag aggregates or natural aggregates, or a combination thereof. If iron blast furnace aggregates or natural aggregates or a combination thereof are used in the mix, each type of aggregate shall be fed to the drier at a uniform rate. The rate of feed of each type of aggregate shall be maintained within 10 percent of the amount set. Adequate means shall be provided for controlling and checking the accuracy of the feeder.

Steel slag aggregate shall be stored separately from iron blast furnace slag aggregate and each type of slag aggregate shall also be stored separately from natural aggregate.

Hot mix asphalt produced from more than one of the following shall not be placed in the same layer: steel slag aggregates, iron blast furnace slag aggregates, natural aggregates or any combination thereof. Once a type of aggregate or aggregates is selected, it shall not be changed without prior approval by the Engineer.

If steel slag aggregates are used to produce hot mix asphalt, and if the specific gravity of a compacted stabilometer test specimen is in excess of 2.40, the quantity of hot mix asphalt to be paid for will be reduced. The stabilometer test specimen will be fabricated in conformance with the procedures in California Test 304 and the specific gravity of the specimen will be determined in conformance with Method C of California Test 308. The pay quantity of hot mix asphalt will be determined by multiplying the quantity of hot mix asphalt placed in the work by 2.40 and dividing the result by the specific gravity of the compacted stabilometer test specimen. Such reduction in quantity will be determined and applied as often as is necessary to ensure accurate results as determined by the Engineer.

## **SECTION 8-2. CONCRETE**

### **8-2.01 PORTLAND CEMENT CONCRETE**

Portland cement concrete shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications and these special provisions.

#### **STRENGTH DEVELOPMENT TIME**

The time allowed to obtain the minimum required compressive strength as specified in Section 90-1.01, "Description," of the Standard Specifications will be 56 days when the Contractor chooses cementitious material that satisfies the following equation:

$$\frac{(41 \times UF) + (19 \times F) + (11 \times SL)}{TC} \geq 7.0$$

Where:

- F = Fly ash or natural pozzolan conforming to the requirements in AASHTO Designation: M 295, Class F or N, including the amount in blended cement, pounds per cubic yard. F is equivalent to either FA or FB as defined in Section 90-2.01C, "Required Use of Supplementary Cementitious Materials," of the Standard Specifications
- SL = GGBFS, including the amount in blended cement, pounds per cubic yard
- UF = Silica fume, metakaolin, or UFFA, including the amount in blended cement, pounds per cubic yard
- TC = Total amount of cementitious material used, pounds per cubic yard

For concrete satisfying the equation above, the Contractor shall test for the modulus of rupture or compressive strength specified for the concrete involved, at least once every 500 cubic yards, at 28, 42, and 56 days. The Contractor shall submit test results to the Engineer and the Transportation Laboratory, Attention: Office of Concrete Materials.

#### **SUPPLEMENTARY CEMENTITIOUS MATERIALS**

The Contractor may use rice hull ash as a supplementary cementitious material (SCM) to make minor concrete. Rice hull ash shall conform to the requirements in AASHTO Designation: M 321 and the following chemical and physical requirements:

Chemical Requirements	Percent
Silicon Dioxide (SiO <sub>2</sub> ) <sup>a</sup>	90 min.
Loss on ignition	5.0 max.
Total Alkalies (as Na <sub>2</sub> O) equivalent	3.0 max.

Physical Requirements	Percent
Particle size distribution	
Less than 45 microns	95
Less than 10 microns	50
Strength Activity Index with portland cement <sup>b</sup>	
7 days	95 (minimum % of control)
28 days	110 (minimum % of control)
Expansion at 16 days when testing job materials in conformance with ASTM C 1567 <sup>c</sup>	0.10 max.
Surface Area when testing by nitrogen adsorption in conformance with ASTM D 5604	40.0 m <sup>2</sup> /g min.

Notes:

<sup>a</sup> A maximum of 1.0% of the SiO<sub>2</sub> may exist in crystalline form.

<sup>b</sup> When tested in conformance with the requirements for strength activity testing of silica fume in AASHTO Designation: M 307

<sup>c</sup> In the test mix, Type II or Type V portland cement shall be replaced with at least 12% RHA by weight.

Rice hull ash will be considered as a Type UF SCM for the purposes of calculating cementitious material requirements in Section 90-2.01C, "Required Use of Supplementary Cementitious Materials," of the Standard Specifications and these special provisions.

### 8-2.02 CORROSION CONTROL FOR PORTLAND CEMENT CONCRETE

Portland cement concrete at Floral Drive Undercrossing (Bridge Number 53-1155) and Retaining Wall 1150 that is in contact with soil is considered to be in a corrosive environment and shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications and these special provisions.

Cementitious material to be used in portland cement concrete shall conform to the provisions in Section 90-2, "Materials," of the Standard Specifications, and shall be a combination of either Type II or Type V portland cement and supplementary cementitious material.

Concrete in a corrosive environment shall contain not less than 675 pounds of cementitious material per cubic yard.

Reduction in the cementitious material content specified or ordered in conformance with the provisions in Section 90-4.05, "Optional Use of Chemical Admixtures," of the Standard Specifications, is not permitted for concrete in a corrosive environment.

For concrete in a corrosive environment, the cementitious material shall be comprised of one of the following:

- A. 25 percent by weight of either fly ash or natural pozzolan with a CaO content of up to 10 percent, and 75 percent by weight of portland cement
- B. 20 percent by weight of either fly ash or natural pozzolan with a CaO content of up to 10 percent, 5 percent by weight of silica fume, and 75 percent by weight of portland cement
- C. 12 percent by weight of either silica fume, metakaolin, or UFFA; and 88 percent by weight of portland cement
- D. 50 percent by weight of ground granulated blast furnace slag, and 50 percent by weight of portland cement

The ratio of the amount of free water to the amount of cementitious material used in concrete in a corrosive environment shall not exceed 0.40.

Full compensation for conforming to the above requirements shall be considered as included in the contract prices paid for the various contract items of work, and no additional compensation will be allowed therefor.

### 8-2.03 RAPID STRENGTH CONCRETE FOR STRUCTURES

#### GENERAL

##### Summary

This section includes specifications for rapid strength concrete (RSC) for structures. You may only use RSC when specified elsewhere in these special provisions.

## **Definitions**

**Opening age:** The age at which the concrete will achieve the specified strength for opening to public or construction traffic.

## **Submittals**

### **Mix Design**

Submit the RSC mix design at least 10 days before use. If a trial slab is required, submit the RSC mix design at least 10 days before constructing the trial slab. Include the following in the submittal:

1. Compressive strength test results for prequalification of RSC at age of break, at 3 days, and at 28 days
2. Opening age
3. Proposed aggregate grading
4. Mix proportions of cementitious material, aggregate, and water
5. Types and amounts of chemical admixtures, if used
6. Range of ambient temperatures over which the mix design will achieve the required minimum compressive strength
7. Source of materials

### **Volumetric Proportioning**

When using volumetric proportioning, submit the following:

1. Aggregate moisture test results
2. Log of production data

### **Certificate of Compliance**

Submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications with each delivery of aggregate, cementitious material, and admixtures used for calibration tests. Include certified copies of the weight of each delivery.

The Certificate of Compliance must state that the source of materials used for the calibration tests is from the same source as to be used for the planned work. The Certificate of Compliance must be signed by an authorized representative.

## **Quality Control and Assurance**

### **Prequalification of RSC**

Prequalification of a RSC mix design includes determining the opening age and achieving the minimum specified 28-day compressive strength.

Prequalify RSC under the specifications for prequalification of concrete specified by compressive strength in Section 90-9.01, "General," of the Standard Specifications. Determine the opening age as follows:

1. Fabricate at least 5 test cylinders to be used to determine the age of break.
2. Immediately after fabrication of the 5 test cylinders, store the cylinders in a temperature medium of  $70 \pm 3$  °F until the cylinders are tested.
3. Determine the age of break to achieve an average strength of the 5 test cylinders of not less than 1200 psi. Not more than 2 test cylinders shall have a strength of less than 1150 psi.
4. The opening age is the age of break plus 1 hour.

### **Weighmaster Certifications**

Weighmaster certificates for RSC, regardless of the proportioning method used, must include all information necessary to trace the manufacturer and manufacturer's lot number for the cement being used. When proportioned into fabric containers, the weighmaster certificates for the cement must contain the date of proportioning, location of proportioning, and actual net draft weight of the cement. When proportioned at the job site from a storage silo, the weighmaster certificates must contain the date of proportioning, location of proportioning, and the net draft weight of the cement used in the load.

## **MATERIALS**

### **General**

RSC must comply with one of the following:

1. Concrete made with portland cement concrete and a nonchloride Type C chemical admixture. The concrete must comply with Section 90, "Portland Cement Concrete," of the Standard Specifications, except that Type III cement may be used.
2. Concrete made with a proprietary cementitious material. The concrete must comply with Section 90, "Portland Cement Concrete," of the Standard Specifications, except that:
  - 2.1. Cementitious material shall meet the definition of hydraulic cement in ASTM C 219, and the following:

**Proprietary Cementitious Material**

Test Description	Test Method	Requirement
Contraction in Air	California Test 527, w/c ratio = 0.39±0.010	0.053%, max.
Mortar Expansion in Water	ASTM C 1038	0.04%, max.
Soluble Chloride*	California Test 422	0.05%, max.
Soluble Sulfate*	California Test 417	0.30%, max.
Thermal Stability	California Test 553	90%, min.
Compressive Strength @ 3 days	ASTM C 109	2500 psi

\*Test is to be done on a cube specimen fabricated in conformance with the requirements in ASTM C 109, cured at least 14 days, and then pulverized so that 100% passes the No. 50 sieve.

- 2.2. Citric acid or borax may be used if requested in writing by the cement manufacturer and a sample is submitted to the Engineer. Chemical admixtures, if used, shall be included when testing for requirements listed in the table above.

RSC must have a minimum 28-day compressive strength of 3600 psi, except that RSC placed in bridge decks must have a minimum 28-day compressive strength of 4500 psi and must comply with the shrinkage limitations as specified for bridge deck concrete in Section 90-1.01, "Description," of the Standard Specifications.

Supplementary cementitious material is not required.

Penetration requirements of Section 90-6.06, "Amount of Water and Penetration," of the Standard Specifications do not apply.

**CONSTRUCTION**

**General**

RSC may be proportioned and placed by a volumetric mixer.

**Volumetric Proportioning**

RSC proportioned by a volumetric mixer must comply with the requirements specified herein.

Proportion liquid admixtures under Section 90-4.10, "Proportioning and Dispensing Liquid Admixtures," of the Standard Specifications, except proportion liquid admixtures with a meter.

Batch-mixer trucks must proportion cement, water, aggregate, and additives by volume. Aggregate feeders must be connected directly to the drive on the cement vane feeder. The cement feed rate must be tied directly to the feed rate for the aggregate and other ingredients. Only change the ratio of cement to aggregate by changing the gate opening for the aggregate feed. The drive shaft of the aggregate feeder must have a revolution counter reading to the nearest full or partial revolution of the aggregate delivery belt.

Proportion aggregate with a belt feeder operated with an adjustable cutoff gate delineated to the nearest quarter increment. The gate opening height must be readily determinable. Proportion cement by any method that complies with the accuracy tolerance specifications. Proportion water with a meter under Section 9-1.01, "Measurement of Quantities," of the Standard Specifications.

Calibrate the cutoff gate for each batch-mixer truck used and for each aggregate source. Calibrate batch-mixer trucks at 3 different aggregate gate settings that are commensurate with production needs. Perform at least 2 calibration runs for each aggregate gate.

Individual aggregate delivery rate check-runs must not deviate more than 1.0 percent from the mathematical average of all runs for the same gate and aggregate type. Each test run must be at least 1,000 pounds.

At the time of batching, dry and drain aggregates to a stable moisture content. Do not proportion aggregates with visible separation of water from the aggregate during proportioning. At the time of batching, the free moisture content of fine aggregate must not exceed 8 percent of its saturated, surface-dry weight.

If the proportioning plant has separate supplies of the same size group of aggregate with different moisture content, specific gravity, or surface characteristics affecting workability, exhaust 1 supply before using another supply.

Cover rotating and reciprocating equipment on batch-mixer trucks with metal guards.

Individual cement delivery rate check-runs must not deviate more than 1.0 percent of the mathematical average of 3 runs of at least 1,000 pounds each.

When the water meter operates between 50 percent and 100 percent of production capacity, the indicated weight of water delivered must not differ from the actual weight delivered by more than 1.5 percent for each of 2 runs of 300 gallons. Calibrate the water meter under California Test 109. The water meter must be equipped with a resettable totalizer and display the operating rate.

Conduct calibration tests for aggregate, cement, and water proportioning devices with a platform scale located at the calibration site. Platform scales for weighing test-run calibration material must have a maximum capacity of 2.75 tons with maximum graduations of 1 pound. Error test the platform scale within 8 hours of calibrating the batch-mixer truck proportioning devices. Perform error-testing with test weights under California Test 109. Furnish a witness scale that is within 2 graduations of the test weight load. The witness scale must be available for use at the production site throughout the production period. Equipment needed for the calibration of proportioning systems must remain available at the production site throughout the production period.

The batch-mixer truck must be equipped so that accuracy checks can be made. Recalibrate proportioning devices every 30 days after production begins or when you change the source or type of any ingredient.

A spot calibration is calibration of the cement proportioning system only. Perform a 2-run spot calibration each time 55 tons of cement passes through the batch-mixer truck. If the spot calibration shows the cement proportioning system does not comply with the specifications, complete a full calibration of the cement proportioning system before you resume production.

Locate cement storage immediately before the cement feeder. Equip the system with a device that automatically shuts down power to the cement feeder and aggregate belt feeder when the cement storage level is less than 20 percent of the total volume.

Determine aggregate moisture under California Test 223 at least every 2 hours during proportioning and mixing operations. Record aggregate moisture determinations and submit them at the end of each production shift.

Equip each aggregate bin with a device that automatically shuts down the power to the cement feeder and the aggregate belt feeder when the aggregate discharge rate is less than 95 percent of the scheduled discharge rate.

Proportioning device indicators must be in working order before beginning proportioning and mixing operations and must be visible when standing near the batch-mixer truck.

Identifying numbers of batch-mixer trucks must be at least 3 inches in height, and be located on the front and rear of the vehicle.

Mix volumetric proportioned RSC in a mechanically operated mixer. You may use auger-type mixers. Operate mixers uniformly at the mixing speed recommended by the manufacturer. Do not use mixers that have an accumulation of hard concrete or mortar.

Do not mix more material than will permit complete mixing. Reduce the volume of material in the mixer if complete mixing is not achieved. Continue mixing until a homogeneous mixture is produced at discharge. Do not add water to the RSC after discharge.

Do not use equipment with components made of aluminum or magnesium alloys that may have contact with plastic concrete during mixing or transporting of RSC.

The Engineer determines uniformity of concrete mixtures by differences in penetration measurements made under California Test 533. Differences in penetration are determined by comparing penetration tests on 2 samples of mixed concrete from the same batch or truck mixer load. The differences must not exceed 5/8 inch. Submit samples of freshly mixed concrete. Sampling facilities must be safe, accessible, clean, and produce a sample that is representative of production. Sampling devices and sampling methods must comply with California Test 125.

Do not use ice to cool RSC directly. If ice is used to cool water used in the mix, it must be melted before entering the mixer.

Proportion and charge cement into a mixer so that there are no losses of cement due to wind or accumulation on equipment, or other conditions that may vary the required quantity of cement.

Each mixer must have metal plates that provide the following information:

1. Designed usage
2. Manufacturer's guaranteed mixed concrete volumetric capacity
3. Rotation speed

The device controlling the proportioning of cement, aggregate, and water must produce production data. The production data must be captured at 15-minute intervals throughout daily production. Each capture of production data represents production activity at that time and is not a summation of data. The amount of material represented by each production capture is the amount produced in the period from 7.5 minutes before to 7.5 minutes after the capture time. Submit the daily production data in electronic or printed media at the end of each production shift. Report the data including data titles in the following order:

1. Weight of cement per revolution count
2. Weight of each aggregate size per revolution count
3. Gate openings for each used aggregate size
4. Weight of water added to the concrete per revolution count
5. Moisture content of each used aggregate size
6. Individual volume of other admixtures per revolution count
7. Time of day
8. Day of week
9. Production start and stop times
10. Batch-mixer truck identification
11. Name of supplier
12. Specific type of concrete being produced
13. Source of the individual aggregate sizes
14. Source, brand, and type of cement
15. Source, brand and type of individual admixtures
16. Name and signature of operator

You may input production data by hand into a pre-printed form or it may be captured and printed by the proportioning device. Present electronic media containing recorded production data in a tab delimited format on a CD or DVD. Each capture of production data must be followed by a line-feed carriage-return with sufficient fields for the specified data.

### **Curing Concrete**

For RSC made with a proprietary cement, the curing method must be as recommended by the manufacturer of the cement and as approved by the Engineer.

For RSC made using portland cement concrete, you must:

1. Cure the concrete using the curing compound method under Section 90-7.03, "Curing Structures," of the Standard Specifications. Fogging of the surface with water after the curing compound has been applied will not be required.
2. Repair immediately any damage to the film of the curing compound with additional compound. Do not repair damage to the curing compound after the concrete is opened to public traffic.
3. Cover the surface with an insulating layer or blanket when the ambient temperature is below 65 °F during the curing period. The insulation layer or blanket shall have an R-value rating given in the table below. A heating tent may be used in lieu of or in combination with the insulating layer or blanket:

**R-Value Ratings**

Temperature Range During Curing Period	R-value, minimum
55 °F to 65 °F	1
45 °F to 55 °F	2
39 °F to 45 °F	3

If compressive strength tests are performed in the field showing that the concrete has achieved 1200 psi, you may open the lane to traffic at the age of break. Perform the compressive strength tests under the provisions for sampling and testing cylinders in Section 90-9.01, "General," of the Standard Specifications. The decision to use this option must be made in writing to the Engineer before beginning construction.

## **8-2.04 PRECAST CONCRETE QUALITY CONTROL**

### **GENERAL**

Precast concrete quality control shall conform to these special provisions.

Unless otherwise specified, precast concrete quality control shall apply when any precast concrete members are fabricated in conformance with the provisions in Section 49, "Piling," or Section 51, "Concrete Structures," of the Standard Specifications.

Precast concrete quality control shall not apply to precast concrete members that are fabricated from minor concrete.

In addition, precast concrete quality control shall apply when precast members are fabricated for the following work:

- A. Precast Prestressed Concrete Pavement

Quality Control (QC) shall be the responsibility of the Contractor. The Contractor's QC inspectors shall perform inspection and testing prior to precasting, during precasting, and after precasting, and as specified in this section and additionally as necessary to ensure that materials and workmanship conform to the details shown on the plans, and to the specifications.

Quality Assurance (QA) is the prerogative of the Engineer. Regardless of the acceptance for a given precast element by the Contractor, the Engineer will evaluate the precast element. The Engineer will reject any precast element that does not conform to the approved Precast Concrete Quality Control Plan (PCQCP), the details shown on the plans, or to these special provisions.

The Contractor shall designate in writing a precast Quality Control Manager (QCM) for each precasting facility. The QCM shall be responsible directly to the Contractor for the quality of precasting, including materials and workmanship, performed by the Contractor and all subcontractors. The QCM shall be the sole individual responsible to the Contractor for submitting, receiving, and approving all correspondence, required submittals, and reports to and from the Engineer. The QCM shall not be employed or compensated by any subcontractor, or other persons or entities hired by subcontractors, or suppliers, who will provide other services or materials for the project. The QCM may be an employee of the Contractor.

Prior to submitting the PCQCP required herein, a meeting between the Engineer, the Contractor's QCM, and a representative from each entity performing precast concrete operations for this project, shall be held to discuss the requirements for precast quality control.

QC Inspectors shall either be 1) licensed as Civil Engineers in the State of California, or 2) have a current Plant Quality Personnel Certification, Level II, from the Precast/Prestressed Concrete Institute. A QC Inspector shall witness all precast concrete operations.

### **PRECAST CONCRETE QUALIFICATION AUDIT**

Unless otherwise specified, no Contractors or subcontractors performing precast concrete operations for the project shall commence work without having successfully completed the Department's Precast Fabrication Qualification Audit, hereinafter referred to as the audit. Copies of the audit form, along with procedures for requesting and completing the audit, are available at:

<http://www.dot.ca.gov/hq/esc/Translab/OSM/smbresources.htm>

An audit that was previously approved by the Department no more than 3 years before the award of this contract will be acceptable for the entire period of this contract, provided the Engineer determines the audit is for the same type of work that is to be performed on this contract.

A list of facilities who have successfully completed the audit and are authorized to provide material for this contract is available at:

[http://www.dot.ca.gov/hq/esc/Translab/OSM/smdocuments/Internet\\_auditlisting.pdf](http://www.dot.ca.gov/hq/esc/Translab/OSM/smdocuments/Internet_auditlisting.pdf)

Successful completion of an audit shall not relieve the Contractor of the responsibility for furnishing materials or producing finished work of the quality specified in these special provisions and as shown on the plans.

### **PRECAST CONCRETE QUALITY CONTROL PLAN**

Prior to performing any precasting operations, the Contractor shall submit to the Engineer, in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, 3 copies of a separate PCQCP for each item of work to be precast. A separate PCQCP shall be submitted for each facility. As a minimum, each PCQCP shall include the following:

- A. The name of the precasting firm, the concrete plants to be used, and any concrete testing firm to be used;
- B. A manual prepared by the precasting firm that includes equipment, testing procedures, safety plan, and the names, qualifications, and documentation of certifications for all personnel to be used;
- C. The name of the QCM and the names, qualifications, and documentation of certifications for all QC inspection personnel to be used;
- D. An organizational chart showing all QC personnel and their assigned QC responsibilities;
- E. The methods and frequencies for performing all required quality control procedures, including all inspections, material testing, and any required survey procedures for all components of the precast elements including prestressing systems, concrete, grout, reinforcement, steel components embedded or attached to the precast member, miscellaneous metal, and formwork;
- F. A system for identification and tracking of required precast element repairs, and a procedure for the reinspection of any repaired precast element. The system shall have provisions for a method of reporting nonconforming precast elements to the Engineer; and
- G. Forms to be used for Certificates of Compliance, daily production logs, and daily reports.

The Engineer shall have 4 weeks to review the PCQCP submittal after a complete plan has been received. No precasting shall be performed until the PCQCP is approved in writing by the Engineer.

A PCQCP that was previously approved by the Engineer no more than one year prior to the beginning of work on this contract will be acceptable for the entire period of this contract, provided the Engineer determines the PCQCP is for the same type of work that is to be performed on this contract.

An amended PCQCP or addendum shall be submitted to, and approved in writing by the Engineer, for any proposed revisions to the approved PCQCP. An amended PCQCP or addendum will be required for any revisions to the PCQCP, including but not limited to changes in concrete plants or source materials, changes in material testing procedures and testing labs, changes in procedures and equipment, changes in QC personnel, or updated systems for tracking and identifying precast elements. The Engineer shall have 2 weeks to complete the review of the amended PCQCP or addendum, once a complete submittal has been received. Work that is affected by any of the proposed revisions shall not be performed until the amended PCQCP or addendum has been approved.

After final approval of the PCQCP, amended PCQCP, or addendum, the Contractor shall submit 7 copies to the Engineer of each of these approved documents.

It is expressly understood that the Engineer's approval of the Contractor's PCQCP shall not relieve the Contractor of any responsibility under the contract for the successful completion of the work in conformance with the requirements of the plans and specifications. The Engineer's approval shall neither constitute a waiver of any of the requirements of the plans and specifications nor relieve the Contractor of any obligation thereunder; and defective work, materials, and equipment may be rejected notwithstanding approval of the PCQCP.

## **REPORTING**

The QC Inspector shall provide reports to the QCM on a daily basis for each day that precasting operations are performed.

A daily production log for precasting shall be kept by the QCM for each day that precasting operations, including setting forms, placing reinforcement, setting prestressing steel, casting, curing, post tensioning, and form release, are performed. The log shall include the facility location, and shall include a specific description of casting or related operations, any problems or deficiencies discovered, any testing or repair work performed, and the names of all QC personnel and the specific QC inspections they performed that day. The daily report from each QC Inspector shall also be included in the log. This daily log shall be available for viewing by the Engineer, at the precasting facility.

All reports regarding material tests and any required survey checks shall be signed by the person who performed the test or check, and then submitted directly to the QCM for review and signature prior to submittal to the Engineer. Corresponding names shall be clearly printed or type-written next to all signatures.

The Engineer shall be notified immediately in writing when any precasting problems or deficiencies are discovered and of the proposed repair or process changes required to correct them. The Engineer shall have 4 weeks to review these procedures. No remedial work shall begin until the Engineer approves these procedures in writing.

The following items shall be included in a precast report that is to be submitted to the Engineer following the completion of any precast element:

- A. Reports of all material tests and any required survey checks;
- B. Documentation that the Contractor has evaluated all tests and corrected all rejected deficiencies, and all repairs have been re-examined with the required tests and found acceptable; and
- C. A daily production log.

At the completion of any precast element, and if the QCM determines that element is in conformance with these special provisions, the QCM shall sign and furnish to the Engineer, a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. This Certificate of Compliance shall be submitted with the precast report. The certificate shall state that all of the materials and workmanship incorporated in the work, and all required tests and inspections of this work, have been performed in conformance with the details shown on the plans and the provisions of the Standard Specifications and these special provisions.

## **PAYMENT**

In the event the Engineer fails to complete the review of 1) a PCQCP, 2) an amended PCQCP or addendum, or 3) a proposed repair or process change, within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

All required repair work or process changes required to correct precasting operation deficiencies, whether discovered by the QCM, QC Inspector, or by the Engineer, and any associated delays or expenses to the Contractor caused by performing these repairs, shall be at the Contractor's expense.

Full compensation for conforming to the requirements of this section shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

## **8-2.05 CONTRACTOR QUALITY CONTROL (CONCRETE PAVEMENT)**

### **GENERAL**

#### **Summary**

This work includes controlling concrete pavement quality.

Comply with Section 40-1.03, "Quality Control and Assurance," of the Standard Specifications.

#### **Submittals**

Before starting paving activities, submit:

1. Quality control plan (QCP). The Engineer has 15 days to review and accept.
2. Plan showing the beam curing area and water service. The Engineer has 5 business days to review and accept.

QCP must include the following additional requirements:

1. Name and qualifications of a Quality Control Manager (QCM). The QCM administers the QCP. Give the QCM authority to make decisions concerning work and product quality. The QCM must be available at the job site during paving. The QCM may not delegate authority except in emergencies and with the Engineer's approval. The QCM must not be a foreman or a production or paving crew member.
2. Organization chart showing quality control lines of authority.
3. List of names and phone numbers of individuals and alternates responsible for quality control including:
  - 3.1. Administration
  - 3.2. Sampling
  - 3.3. Testing
  - 3.4. Inspection
4. List of inspection, sampling, and testing personnel with their:
  - 4.1. Names
  - 4.2. Duties
  - 4.3. Qualifications
  - 4.4. Experience
5. For each laboratory used:
  - 5.1. Laboratory name and location
  - 5.2. Name and qualifications of a Laboratory Quality Control Manager
  - 5.3. Names of testers
6. Approved:
  - 6.1. Test result forms
  - 6.2. Roadway and plant inspection forms
  - 6.3. Daily Quality Control Summary form
  - 6.4. Compliance charts
7. Random sampling methods
8. List of testing and sampling equipment to be used
9. Current calibration dates and charts

If there are changes to quality control procedures or personnel, modify the QCP with a supplement. Until the Engineer accepts the changes, do not produce or place concrete pavement.

Documentation forms include:

1. Data sheets for test results and calculations
2. Daily Quality Control Summary Sheet that facilitates the Engineer's computation of moving test averages and describes quality control actions to be taken, including adjustments to:
  - 2.1. Aggregate proportions
  - 2.2. Admixture proportions
  - 2.3. Moisture

Submit documents for testing and inspection. Documents must indicate:

1. Nature and number of observations
2. Number and type of deficiencies
3. Quantities accepted and rejected
4. Corrective action taken

Submit construction activity documents before contract acceptance.

### **Quality Control and Assurance**

Provide quality control inspectors and testers for concrete pavement production and placement.

Inspectors must inspect concrete pavement construction equipment for proper operation periodically as specified in the QCP.

Calibrate testing equipment under the equipment manufacturer's instructions.

Provide a testing facility at the plant site or job site.

Allow the Engineer use of the testing facility including the facility's:

1. Telephone
2. Copying machine
3. Facsimile machine

Provide a safe and secure area for the Engineer to cure beam specimens. The curing area must include access to potable water through a pressurized water line with a hose bib.

Develop and maintain a filing system for construction activity documents including:

1. Reports
2. Charts
3. Records
4. Diaries

For the early age concrete pavement stress/strength system, use the latest version of HiperPav computer program or an equal prediction model.

### **PAYMENT**

The Department does not adjust payment or contract time for repair work required when the QCM or quality control inspectors identify a deficiency.

Full compensation for Contractor quality control is included in the contract price paid per cubic yard for concrete pavement as designated in the Engineer's Estimate and no separate payment will be made therefor.

## **8-2.06 SELF-CONSOLIDATING CONCRETE FOR PRECAST ELEMENTS**

### **GENERAL**

#### **Summary**

This section includes specifications for self-consolidating concrete (SCC). You may use SCC for precast concrete.

#### **Definitions**

**self-consolidating concrete:** Flowing concrete capable of spreading to a level state without segregation and without the use of internal or external vibrators.

### Submittals

Submit the following for approval before placing SCC:

1. SCC mix design and placement procedures
2. Trial batch test report

### Quality Control and Assurance

#### General

Prepare SCC specimens for compressive strength testing under California Test 540 except fabricate test specimens as follows:

1. Place test molds on a firm, flat surface to prevent distortion of the bottom surface. When more than 1 specimen is to be made from the same batch, make all specimens simultaneously. Fill the mold in 1 lift, pouring the concrete from a larger container. Pat sides of the mold lightly by hand, or jig by rocking the mold from side to side.
2. Strike off the surface of the concrete even with the top edge of the mold. Wipe the sides of the mold free of excess concrete and press the lid on.

#### Prequalification of SCC Mix Design

Prequalify the SCC mix design with a trial batch using the same materials, mix proportions, mixing equipment, procedures, and size of batch to be used in the production of SCC. The trial batch test report for the SCC mix design must include the following tests and results:

**SCC Mix Design Requirements**

Property	Requirement	Test Method
Slump Flow	At least 20 inches	ASTM C 1611
Flow Rate - T <sub>50</sub>	Between 2 and 7 seconds	ASTM C 1611
Visual Stability Index	1.0 or less	ASTM C 1611
J-Ring Flow	The difference between J-Ring flow and the slump flow must not exceed 2 inches	ASTM C 1621
Column Segregation	Static segregation must not exceed 15%	ASTM C 1610
Bleeding	Bleeding capacity must not exceed 2.5%	ASTM C 232
Compressive Strength	The average of 5 test cylinders must be at least 580 psi greater than the specified strength. <sup>a</sup>	California Test 521
Minimum Compressive Strength	The minimum for an individual test cylinder must not be less than the specified strength. <sup>a</sup>	California Test 521

Note:

<sup>a</sup> At the maximum age specified or allowed

#### Field Quality Control

Determine the fine aggregate moisture content for each batch of SCC.

Determine slump flow and visual stability index (VSI) at the beginning of SCC placement and whenever a set of concrete cylinders is prepared. The slump flow must not vary by more than 3 inches from the mix design slump flow, and the minimum allowable slump flow is 20 inches. VSI must be 1.0 or less. If the Engineer rejects SCC for slump flow and VSI, make corrective changes in the SCC mix design or placement procedures before placing additional SCC. Submit revised SCC mix design or placement procedures for approval.

**MATERIALS**

SCC must comply with Section 90, "Portland Cement Concrete," of the Standard Specifications except Section 90-3, "Aggregate Gradings," of the Standard Specifications does not apply.

**PAYMENT**

The Department measures and pays for SCC under the specifications requiring or allowing its use.

**SECTION 8-3. WELDING**

**8-3.01 WELDING**

**GENERAL**

Unless otherwise specified, Section 8-3, "Welding," shall apply to any welding that is specified to conform to an AWS welding code.

Requirements of the AWS welding codes shall apply unless otherwise specified in the Standard Specifications, on the plans, or in these special provisions. Wherever the abbreviation AWS is used, it shall be equivalent to the abbreviations ANSI/AWS or AASHTO/AWS.

Wherever reference is made to the following AWS welding codes in the Standard Specifications, on the plans, or in these special provisions, the year of adoption for these codes shall be as listed:

AWS Code	Year of Adoption
D1.1	2008
D1.3	2008
D1.4	2005
D1.5	2008
D1.6	2007
D1.8	2009

Flux cored welding electrodes conforming to the requirements of AWS A5.20 E6XT-4 or E7XT-4 shall not be used to perform welding for this project.

Unless otherwise specified, Clause 6.1.3 of AWS D1.1, paragraph 1 of Section 7.1.2 of AWS D1.4, and Clause 6.1.1.2 of AWS D1.5, are replaced with the following:

The QC Inspector shall be the duly designated person who acts for and on behalf of the Contractor for inspection, testing, and quality related matters for all welding.

Quality Assurance (QA) is the prerogative of the Engineer. The QA Inspector is the duly designated person who acts for and on behalf of the Engineer.

The QC Inspector shall be responsible for quality control acceptance or rejection of materials and workmanship.

When the term "Inspector" is used without further qualification, it shall refer to the QC Inspector.

Inspection and approval of all joint preparations, assembly practices, joint fit-ups, welding techniques, and the performance of each welder, welding operator, and tack welder shall be documented by the QC Inspector on a daily basis for each day welding is performed. For each inspection, including fit-up, Welding Procedure Specification (WPS) verification, and final weld inspection, the QC Inspector shall confirm and document compliance with the requirements of the AWS or other specified code criteria and the requirements of these special provisions on all welded joints before welding, during welding, and after the completion of each weld.

The Engineer shall have the authority to verify the qualifications or certifications of any welder, QC Inspector, or NDT personnel to specified levels by retests or other means approved by the Engineer.

When joint weld details that are not prequalified to the details of Clause 3 of AWS D1.1 or to the details of Figure 2.4 or 2.5 of AWS D1.5 are proposed for use in the work, the joint details, their intended locations, and the proposed welding parameters and essential variables, shall be approved by the Engineer. The Contractor shall allow the Engineer 15 days to complete the review of the proposed joint detail locations.

In addition to the requirements of AWS D1.1, welding procedure qualifications for work welded in conformance with this code shall conform to the following:

When a nonstandard weld joint is to be made using a combination of WPSs, a single test may be conducted combining the WPSs to be used in production, provided the essential variables, including weld bead placement, of each process are limited to those established in Table 4.5.

Upon approval of the proposed joint detail locations and qualification of the proposed joint details, welders and welding operators using these details shall perform a qualification test plate using the WPS variables and the joint detail to be used in production. The test plate shall have the maximum thickness to be used in production and a minimum length of 18 inches. The test plate shall be mechanically and radiographically tested. Mechanical and radiographic testing and acceptance criteria shall be as specified in the applicable AWS codes.

The Engineer will witness all qualification tests for WPSs that were not previously approved by the Department.

In addition to the requirements specified in the applicable code, the period of effectiveness for a welder's or welding operator's qualification shall be a maximum of 3 years for the same weld process, welding position, and weld type. If welding will be performed without gas shielding, then qualification shall also be without gas shielding. Excluding welding of fracture critical members, a valid qualification at the beginning of work on a contract will be acceptable for the entire period of the contract, as long as the welder's or welding operator's work remains satisfactory.

The Contractor shall notify the Engineer 7 days prior to performing any procedure qualification tests. Witnessing of qualification tests by the Engineer shall not constitute approval of the intended joint locations, welding parameters, or essential variables. The Contractor shall notify the Engineer using the "Standard TL-38 Inspection Form" located at:

<http://www.dot.ca.gov/hq/esc/Translab/OSM/smbforms.htm>

Clause 6.14.6, "Personnel Qualification," of AWS D1.1, Section 7.8, "Personnel Qualification," of AWS D1.4, and Clause 6.1.3.4, "Personnel Qualification," of AWS D1.5 are replaced with the following:

Personnel performing nondestructive testing (NDT) shall be qualified and certified in conformance with the requirements of the American Society for Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A and the Written Practice of the NDT firm. The Written Practice of the NDT firm shall meet or exceed the guidelines of the ASNT Recommended Practice No. SNT-TC-1A. Individuals who perform NDT, review the results, and prepare the written reports shall be either:

- A. Certified NDT Level II technicians, or;
- B. Level III technicians who hold a current ASNT Level III certificate in that discipline and are authorized and certified to perform the work of Level II technicians.

Clause 6.6.5, "Nonspecified NDT Other than Visual," of AWS D1.1, Section 7.6.5 of AWS D1.4 and Clause 6.6.5 of AWS D1.5 shall not apply.

For any welding, the Engineer may direct the Contractor to perform NDT that is in addition to the visual inspection or NDT specified in the AWS or other specified welding codes, in the Standard Specifications, or in these special provisions. Except as provided for in these special provisions, additional NDT required by the Engineer, and associated repair work, will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications. Prior to release of welded material by the Engineer, if testing by NDT methods other than those originally specified discloses an attempt to defraud or reveals a gross nonconformance, all costs associated with the repair of the deficient area, including NDT of the weld and of the repair, and any delays caused by the repair, shall be at the Contractor's expense. A gross nonconformance is defined as the sum of planar type rejectable indications in more than 20 percent of the tested length.

When less than 100 percent of NDT is specified for any weld, it is expected that the entire length of weld meet the specified acceptance-rejection criteria. Should any welding deficiencies be discovered by additional NDT directed or performed by the Engineer that utilizes the same NDT method as that originally specified, all costs associated with the repair of the deficient area, including NDT of the weld and of the weld repair, and any delays caused by the repair, shall be at the Contractor's expense.

Repair work to correct welding deficiencies discovered by visual inspection directed or performed by the Engineer, and any associated delays or expenses caused to the Contractor by performing these repairs, shall be at the Contractor's expense.

### **WELDING QUALITY CONTROL**

Welding quality control shall conform to the requirements in the AWS or other specified welding codes, the Standard Specifications, and these special provisions.

Unless otherwise specified, welding quality control shall apply to work welded in conformance with the provisions in the following:

- A. Section 49, "Piling," Section 52, "Reinforcement," Section 55, "Steel Structures," and Section 75-1.035, "Bridge Joint Restrainer Units," of the Standard Specifications
- B. "Structural Steel for Building Work" of these special provisions

Unless otherwise specified, Clauses 6.1.4.1 and 6.1.4.3 of AWS D1.1, paragraph 2 of Section 7.1.2 of AWS D1.4, and Clauses 6.1.3.2 through 6.1.3.3 of AWS D1.5 are replaced with the following:

The QC Inspector shall be currently certified as an AWS Certified Welding Inspector (CWI) in conformance with the requirements in AWS QC1, "Standard for AWS Certification of Welding Inspectors."

The QC Inspector may be assisted by an Assistant QC Inspector provided that this individual is currently certified as an AWS Certified Associate Welding Inspector (CAWI) in conformance with the requirements in AWS QC1, "Standard for AWS Certification of Welding Inspectors." The Assistant QC Inspector may perform inspection under the direct supervision of the QC Inspector provided the assistant is always within visible and audible range of the QC Inspector. The QC Inspector shall be responsible for signing all reports and for determining if welded materials conform to workmanship and acceptance criteria. The ratio of QC Assistants to QC Inspectors shall not exceed 5 to 1.

The Contractor shall designate in writing a welding Quality Control Manager (QCM). The QCM shall be responsible directly to the Contractor for the quality of welding, including materials and workmanship, performed by the Contractor and subcontractors.

The QCM shall be the sole individual responsible to the Contractor for submitting, receiving, reviewing, and approving all correspondence, required submittals, and reports to and from the Engineer. The QCM shall be a registered professional engineer or shall be currently certified as a CWI.

Unless the QCM is hired by a subcontractor providing only QC services, the QCM shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project. The QCM may be an employee of the Contractor.

The QCM shall sign and furnish to the Engineer, a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each item of work for which welding was performed. The certificate shall state that all of the materials and workmanship incorporated in the work, and all required tests and inspections of this work, have been performed in conformance with the details shown on the plans, the Standard Specifications, and these special provisions.

Welding inspection personnel or NDT firms to be used in the work shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project, except for the following conditions:

- A. The work is welded in conformance with AWS D1.5 and is performed at a permanent fabrication or manufacturing facility that is certified under the AISC Quality Certification Program, Category CBR, Major Steel Bridges and Fracture Critical endorsement F, when applicable.
- B. Structural steel for building work is welded in conformance with AWS D1.1 and is performed at a permanent fabrication or manufacturing facility that is certified under the AISC Quality Certification Program, Category STD, Standard for Steel Building Structures.

For welding performed at such facilities, the inspection personnel or NDT firms may be employed or compensated by the facility performing the welding provided the facility maintains a QC program that is independent from production.

Unless otherwise specified, an approved independent third party will witness the qualification tests for welders or welding operators. The independent third party shall be a current CWI and shall not be an employee of the contractor performing the welding. The Contractor shall allow the Engineer 15 days to review the qualifications and copy of the current certification of the independent third party.

Prior to submitting the Welding Quality Control Plan (WQCP) required herein, a prewelding meeting between the Engineer, the Contractor's QCM, and a representative from each entity performing welding or inspection for this project, shall be held to discuss the requirements for the WQCP.

Information regarding the contents, format, and organization of a WQCP, is available at the Transportation Laboratory and at:

<http://www.dot.ca.gov/hq/esc/Translab/OSM/smbresources.htm>

The Contractor shall submit to the Engineer, in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, 2 copies of a separate WQCP for each subcontractor or supplier for each item of work for which welding is to be performed.

The Contractor shall allow the Engineer 15 days to review the WQCP submittal after a complete plan has been received. No welding shall be performed until the WQCP is approved in writing by the Engineer.

An amended WQCP or any addendum to the approved WQCP shall be submitted to, and approved in writing by the Engineer, for proposed revisions to the approved WQCP. An amended WQCP or addendum will be required for revisions to the WQCP, including but not limited to a revised WPS; additional welders; changes in NDT firms, QC, or NDT personnel or procedures; or updated systems for tracking and identifying welds. The Engineer shall have 7 days to complete the review of the amended WQCP or addendum. Work affected by the proposed revisions shall not be performed until the amended WQCP or addendum has been approved.

After final approval of the WQCP, amended WQCP, or addendum, the Contractor shall submit 7 copies to the Engineer of the approved documents. A copy of the Engineer approved document shall be available at each location where welding is to be performed.

All welding will require inspection by the Engineer. The Contractor shall request inspection at least 3 business days prior to the beginning of welding for locations within California and 5 business days for locations outside of California. The Contractor shall request inspection at:

<http://www.dot.ca.gov/hq/esc/Translab/OSM/smbforms.htm>

Continuous inspection shall be provided when any welding is being performed. Continuous inspection, as a minimum, shall include having a QC Inspector within such close proximity of all welders or welding operators so that inspections by the QC Inspector of each welding operation at each welding location does not lapse for a period exceeding 30 minutes.

A daily production log for welding shall be kept for each day that welding is performed. The log shall clearly indicate the locations of all welding. The log shall include the welders' names, amount of welding performed, any problems or deficiencies discovered, and any testing or repair work performed, at each location. The daily report from each QC Inspector shall also be included in the log.

The following items shall be included in a Welding Report that is to be submitted to the Engineer within 15 days following the performance of any welding:

- A. A daily production log.
- B. Reports of all visual weld inspections and NDT.
- C. Radiographs and radiographic reports, and other required NDT reports.
- D. A summary of welding and NDT activities that occurred during the reporting period.
- E. Reports of each application of heat straightening.
- F. A summarized log listing the rejected lengths of weld by welder, position, process, joint configuration, and piece number.
- G. Documentation that the Contractor has evaluated all radiographs and other nondestructive tests and corrected all rejectable deficiencies, and that all repaired welds have been reexamined using the required NDT and found acceptable.

The following information shall be clearly written on the outside of radiographic envelopes: name of the QCM, name of the nondestructive testing firm, name of the radiographer, date, contract number, complete part description, and all included weld numbers, report numbers, and station markers or views, as detailed in the WQCP. In addition, all interleaves shall have clearly written on them the part description and all included weld numbers and station markers or views, as detailed in the WQCP. A maximum of 2 pieces of film shall be used for each interleave.

Reports of all visual inspections and NDT shall be signed by the inspector or technician and submitted daily to the QCM for review and signature prior to submittal to the Engineer. Corresponding names shall be clearly printed or typewritten next to all signatures. Reports of all NDT, whether specified, additional, or informational, performed by the Contractor shall be submitted to the Engineer.

The Engineer will review the Welding Report to determine if the Contractor is in conformance with the WQCP. Except for field welded steel pipe piling, the Engineer shall be allowed 15 days to review the report and respond in writing after the complete Welding Report has been received. Prior to receiving notification from the Engineer of the Contractor's conformance with the WQCP, the Contractor may encase in concrete or cover welds for which the Welding Report has been submitted. However, should the Contractor elect to encase or cover those welds prior to receiving notification from the Engineer, it is expressly understood that the Contractor shall not be relieved of the responsibility for incorporating material in the work that conforms to the requirements of the plans and specifications. Material not conforming to these requirements will be subject to rejection.

For field welded steel pipe piling, including bar reinforcement in the piling, the Contractor shall allow the Engineer 2 business days to review the Welding Report and respond in writing after the required items have been received. No field welded steel pipe piling shall be installed, and no reinforcement in the piling shall be encased in concrete until the Engineer has approved the above requirements in writing.

In addition to the requirements in AWS D1.1 and AWS D1.5, third-time excavations of welds or base metal to repair unacceptable discontinuities, regardless of NDT method, and all repairs of cracks require prior approval of the Engineer.

The Engineer shall be notified immediately in writing when welding problems, deficiencies, base metal repairs, or any other type of repairs not submitted in the WQCP are discovered, and also of the proposed repair procedures to correct them. For requests to perform third-time excavations or repairs of cracks, the Contractor shall include an engineering evaluation of the proposed repair. The engineering evaluation, at a minimum, shall address the following:

- A. What is causing each defect?
- B. Why the repair will not degrade the material properties?
- C. What steps are being taken to prevent similar defects from happening again?

The Contractor shall allow the Engineer 7 days to review these procedures. No remedial work shall begin until the repair procedures are approved in writing by the Engineer.

Clause 6.5.4 of AWS D1.5 is replaced with the following:

The QC Inspector shall inspect and approve each joint preparation, assembly practice, welding technique, joint fit-up, and the performance of each welder, welding operator, and tack welder to make certain that the applicable requirements of this code and the approved Welding Procedure Specification (WPS) are met. The QC Inspector shall examine the work to make certain that it meets the requirements of Clauses 3 and 6.26. The size and contour of all welds shall be measured using suitable gages. Visual inspection for cracks in welds and base metal, and for other discontinuities shall be aided by strong light, magnifiers, or such other devices as may be helpful. Acceptance criteria different from those specified in this code may be used when approved by the Engineer.

In addition to the requirements of AWS D1.5, Clause 5.12 or 5.13, welding procedures qualification for work welded in conformance with that code shall conform to the following requirements:

- A. Unless considered prequalified, fillet welds shall be qualified in each position. The fillet weld soundness test shall be conducted using the essential variables of the WPS as established by the Procedure Qualification Record (PQR).
- B. For qualification of joints that do not conform to Figures 2.4 and 2.5 of AWS D1.5, a minimum of 2 WPS qualification tests are required. The tests shall be conducted using both Figure 5.1 and Figure 5.3. The test conforming to Figure 5.1 shall be conducted in conformance with AWS D1.5, Clause 5.12 or 5.13. The test conforming to Figure 5.3 shall be conducted using the welding electrical parameters that were established for the test conducted conforming to Figure 5.1. The ranges of welding electrical parameters established during welding per Figure 5.1 in conformance with AWS D1.5, Clause 5.12, shall be further restricted according to the limits in Table 5.3 during welding per Figure 5.3.
- C. Multiple zones within a weld joint may be qualified. The travel speed, amperage, and voltage values that are used for tests conducted per AWS D1.5 Clause 5.13 shall be consistent for each pass in a weld joint, and shall in no case vary by more than  $\pm 10$  percent for travel speed,  $\pm 10$  percent for amperage, and  $\pm 7$  percent for voltage as measured from a predetermined target value or average within each weld pass or zone. The travel speed shall in no case vary by more than  $\pm 15$  percent when using submerged arc welding.
- D. For a WPS qualified in conformance with AWS D1.5 Clause 5.13, the values to be used for calculating ranges for current and voltage shall be based on the average of all weld passes made in the test. Heat input shall be calculated using the average of current and voltage of all weld passes made in the test for a WPS qualified in conformance with Clause 5.12 or 5.13.
- E. Macroetch tests are required for WPS qualification tests, and acceptance shall be per AWS D1.5 Clause 5.19.3.
- F. When a nonstandard weld joint is to be made using a combination of WPSs, a test conforming to Figure 5.3 may be conducted combining the WPSs to be used in production, provided the essential variables, including weld bead placement, of each process are limited to those established in Table 5.3.
- G. Prior to preparing mechanical test specimens, the PQR welds shall be inspected by visual and radiographic tests. Backing bar shall be 3 inches in width and shall remain in place during NDT testing. Results of the visual and radiographic tests shall comply with AWS D1.5 Clause 6.26.2, excluding Clause 6.26.2.2. Test plates that do not comply with both tests shall not be used.

## **WELDING FOR OVERHEAD SIGN AND POLE STRUCTURES**

The Contractor shall meet the following requirements for any work welded in conformance with the provisions in Section 56-1, "Overhead Sign Structures," or Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications.

Welding inspection personnel or NDT firms to be used in the work shall not be employed or compensated by any subcontractor or by other persons or entities hired by subcontractors who will provide other services or materials for the project except for when the welding is performed at a permanent fabrication or manufacturing facility that is certified under the AISC Quality Certification Program. The AISC Certification category for overhead sign structures shall be Simple Steel Bridge Structures (SBR), and the AISC Certification category for pole structures shall be Simple Steel Bridge Structures (SBR) or Standard for Steel Building Structures (STD).

### **Welding Qualification Audit**

Contractors or subcontractors performing welding operations for overhead sign and pole structures shall have successfully completed the Department's "Manufacturing Qualification Audit for Overhead Sign and Pole Structures." Copies of the audit form and procedures for requesting and completing the audit are available at:

<http://www.dot.ca.gov/hq/esc/Translab/OSM/smbresources.htm>

An audit that was approved by the Engineer no more than 3 years prior to the award of the contract will be acceptable for the entire period of this contract provided the Engineer determines the audit was for the same type of work that is to be performed on this contract.

A list of facilities that have successfully completed the audit and are authorized to provide material for this contract is available at:

[http://www.dot.ca.gov/hq/esc/Translab/OSM/smdocuments/Internet\\_auditlisting.pdf](http://www.dot.ca.gov/hq/esc/Translab/OSM/smdocuments/Internet_auditlisting.pdf)

Successful completion of an audit shall not relieve the Contractor of the responsibility for furnishing materials or producing finished work of the quality specified in these special provisions and as shown on the plans.

### **Welding Report**

For work welded in conformance with the provisions in Section 56-1, "Overhead Sign Structures," or Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications, a Welding Report shall be submitted in conformance with the provisions in "Welding Quality Control" of these special provisions.

## **STEEL PIPE PILING QUALIFICATION AUDIT**

The Contractor shall submit documentation that one of the following steel pipe piling qualification audits has been successfully completed before welding operations are performed, other than field welding, for steel pipe piling:

- A. "Class R Steel Pipe Piling Qualification Audit"
- B. "Class N Steel Pipe Piling Qualification Audit"

An audit shall have been completed for each pipe pile diameter, thickness, grade of steel, and class of piling to be supplied for this project. The procedures for requesting and completing the audit are available at:

<http://www.dot.ca.gov/hq/esc/Translab/OSM/smbresources.htm>

An audit that was approved by the Department no more than 3 years prior to the award of the contract will be acceptable for the entire period of this contract provided the Engineer determines the audit was for the same type of work that is to be performed on this contract.

A list of facilities that have successfully completed the audit and are authorized to provide material for this contract is available at:

[http://www.dot.ca.gov/hq/esc/Translab/OSM/smdocuments/Internet\\_auditlisting.pdf](http://www.dot.ca.gov/hq/esc/Translab/OSM/smdocuments/Internet_auditlisting.pdf)

Successful completion of an audit shall not relieve the Contractor of the responsibility for furnishing materials or producing finished work of the quality specified in these special provisions and as shown on the plans.

## **PAYMENT**

Full compensation for conforming to the requirements of "Welding" shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

## **SECTION 9. DESCRIPTION OF BRIDGE WORK**

The bridge work on this project consists, in general, of removing portions of bridges, constructing bridge widenings, and constructing retaining walls at the following locations as described briefly.

### **LOS ANGELES RIVER BRIDGE (Bridge Number 53-0828)**

This bridge consists of continuous four span riveted and welded steel plate non-composite girders with reinforced concrete seated abutments and solid pier bents, all supported on concrete piles. This bridge was widened in the center with welded steel plate girders. This bridge will be widened on both sides with continuous four span welded steel plate girders with reinforced concrete seated abutments and solid pier bents, all supported on driven open end steel pipe piles.

### **ATLANTIC BOULEVARD SOUTHBOUND ON-RAMP (Bridge Number 53-1008K)**

This bridge, which will be removed, consists of continuous two span reinforced concrete box girder (3 cells) with closed end abutment walls and single column bent, all supported on concrete piles.

### **ATLANTIC BOULEVARD ON-RAMP UNDERCROSSING (Bridge Number 53-3067)**

This new bridge will consist of a single span cast-in-place prestressed box girder (4 cells) with reinforced concrete abutments all supported on driven steel H piles.

### **ATLANTIC BOULEVARD UNDERCROSSING (Bridge Number 53-1009)**

This bridge consists of continuous two span combination of reinforced concrete box girder (12 cell) and precast prestressed concrete I girder (5) with closed end abutment walls and six column bent all supported on concrete piles. This bridge will be widened on both sides with precast prestressed rectangular girders with closed end abutment walls supported on driven open end steel pipe piles and single column bents supported on cast-in-drilled-hole concrete piles.

### **ROUTE 710/5 SEPARATION (EAST) (Bridge Number 53-0785R)**

This bridge consists of continuous eight span combination of reinforced concrete and cast-in-place prestressed box girder (5 to 10 cell) with seated abutments and two to three column bents, all supported on cast-in-drilled-hole concrete piles. The bridge will be widened on the right side with a combination of cast-in-place prestressed concrete box girder in Frame 1 and reinforced concrete box girder in Frames 2 and 3, with diaphragm abutment at Abutment 1 and seated abutment at Abutment 9 and single column bents, supported on driven open end steel pipe piles at Abutment 9 and cast-in-drilled-hole concrete piles at all other locations.

### **ROUTE 710/5 SEPARATION (WEST) (Bridge Number 53-0788L)**

This bridge consists of continuous seven span combination of reinforced concrete box girder (4 cell) and precast prestressed concrete inverted T girder (5 to 7) with seated abutments and two column bents, all supported on cast-in-drilled-hole concrete piles. The bridge will be widened on the left side with continuous eight span reinforced concrete box girder (1 cell) with seated abutments and one column bents, all supported on cast-in-drilled hole concrete piles.

### **OLYMPIC BOULEVARD UNDERCROSSING (Bridge Number 53-1044)**

This bridge consists of original section consisting of a single span reinforced concrete box girder (14 cell) with rigid frame abutments supported on concrete piles and widened and lengthened sections on both sides consisting of cast-in-place prestressed concrete box girder center span and reinforced concrete T beam end spans with closed end cellular bin abutments, all supported on concrete piers. The bridge will be widened on the right side with precast prestressed concrete U girder with closed end bin abutments, all supported on cast-in-drilled-hole concrete piles.

### **WHITTIER BOULEVARD UNDERCROSSING (Bridge Number 53-1150)**

This bridge consists of single span simply supported composite welded steel plate girders (19) with closed end backfilled cantilever abutments all supported on cast-in-drilled-hole concrete piles. The bridge will be widened on the left side with single span precast prestressed concrete rectangular girder with seated closed end backfilled cantilever abutment with wingwall supported by micropiles.

**FLORAL DRIVE UNDERCROSSING**  
(Bridge Number 53-1155)

This bridge consists of two originally constructed simply supported single span reinforced concrete box girder (7 cells each) and outside widenings of single span cast-in-place prestressed concrete box girder (4 cell left and 3 cell right) and median widening of simply supported single span reinforced concrete box girder (4 cell) all with closed end strutted abutments all supported on spread footings except for the median widening, which is supported on cast-in-drilled-hole concrete piles. The bridge will be widened on the right side with single span precast prestressed concrete U girder with closed end strutted abutment supported on cast-in-drilled-hole concrete piles.

**RETAINING WALL 1150**  
(Bridge Number 53E0160)

This new structure consists of a reinforced concrete cantilever retaining wall supported on spread footings and cast-in-drilled-hole concrete piles.

**RETAINING WALL 1271**  
(Bridge Number 53E0158)

This new structure consists of a steel soldier pile retaining wall with treated timber lagging and reinforced concrete pile cap and facing.

**SECTION 10. CONSTRUCTION DETAILS**

**SECTION 10-1. GENERAL**

**10-1.00 CONSTRUCTION PROJECT INFORMATION SIGNS**

Before any major physical construction work readily visible to highway users is started on this contract, the Contractor shall furnish and erect 4 Type 2 Construction Project Information signs at the locations designated by the Engineer.

The signs and overlays shall be of a type and material consistent with the estimated time of completion of the project and shall conform to the details shown on the plans.

The sign letters, the border and the Department's construction logos shall conform to the colors (non-reflective) and details shown on the plans, and shall be on a white background (non-reflective). The colors blue and orange shall conform to PR Color Number 3 and Number 6, respectively, as specified in the Federal Highway Administration's Color Tolerance Chart.

The sign message to be used for fund types shall consist of the following, in the order shown:

FEDERAL HIGHWAY TRUST FUNDS
STATE HIGHWAY FUNDS

The sign message to be used for type of work shall consist of the following:

HIGHWAY CONSTRUCTION  
BRIDGE CONSTRUCTION

The sign message to be used for the Year of Completion of Project Construction will be furnished by the Engineer. The Contractor shall furnish and install the "Year" sign overlay within 10 working days of notification of the year date to be used.

The letter sizes to be used shall be as shown on the plans. The information shown on the signs shall be limited to that shown on the plans.

The signs shall be kept clean and in good repair by the Contractor.

Upon completion of the work, the signs shall be removed and disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13 of the Standard Specifications.

Full compensation for furnishing, erecting, maintaining, and removing and disposing of the construction project information signs shall be considered as included in the contract lump sum price paid for construction area signs and no additional compensation will be allowed therefor.

### 10-1.01 ORDER OF WORK

Order of work shall conform to the provisions in Section 5-1.05, "Order of Work," of the Standard Specifications and these special provisions.

Attention is directed to "Remove Traffic Stripe and Pavement Marking," of these special provisions.

Attention is directed to "Concrete Pavement," of these special provisions in regards to providing Pre-Operation Conference and the Just-In-Time Training prior to commencing pavement replacement operations.

Attention is directed to "Cultural Resources," and "General Migratory Bird Treaty Act," of these special provisions.

Attention is directed to "Water Pollution Control," of these special provisions regarding the submittal and approval of Storm Water Pollution Prevention Plan prior to performing work having potential to cause water pollution.

Prior to beginning work on concrete with architectural surfaces, the Contractor shall construct test panels conforming to "Architectural Surface (Textured Concrete)," of these special provisions.

Complete the construction of deck ribs at Route 710/5 Separation (East) (Bridge Number 53-0785R) before starting work on polyester concrete overlay.

Do not place methacrylate resin on concrete until it has cured for 30 days.

At the Los Angeles River Bridge (Bridge Number 53-0828) no open trenches will be allowed in the channel top levee or the invert of the Los Angeles River from October 15 to April 15.

Attention is directed to "Maintaining Traffic," of these special provisions in regards to providing Transportation Management Plan.

Portions of this project are located within the jurisdiction of Bell Gardens, South Gate, Alhambra, City of Commerce, Monterey Park, Vernon, Maywood, Bell, Cudahy, and County of Los Angeles. You must obtain temporary street occupancy permits for installation of detour signs and signs shown on the motorist information plans during freeway closure hours prior to construction. You will be reimbursed for the permit fee. You must be fully informed of the requirements, rules, regulations and conditions that may govern your operation in Bell Gardens, Downey, City of Commerce, Monterey Park, Vernon, Maywood, Bell, Cudahy, and County of Los Angeles and must conduct the work accordingly.

Have copies of permits available at the work site during periods of active work and present copies to city personnel upon request.

Attention is directed to "Slope Paving" of these special provisions regarding constructing a 4' x 6' test panel prior to placing the permanent slope paving.

Attention is directed to "Jointed Plain Concrete Pavement (Rapid Strength Concrete)," "Jointed Plain Concrete Pavement," and "Precast Prestressed Concrete Pavement," of these special provisions in regards to providing Pre-Operation Conference and the Just-In-Time Training prior to commencing pavement replacement operations.

The first order of work shall be to place the order for the fiber optic cables and electrical equipment.

Attention is directed to "Maintaining Traffic" and "Temporary Pavement Delineation" of these special provisions and to the stage construction sheets of the plans.

Attention is directed to "Progress Schedule (Critical Path Method)" of these special provisions regarding the submittal of a general time-scaled logic diagram within 10 days after approval of the contract. The diagram shall be submitted prior to performing any work that may be affected by any proposed deviations to the construction staging of the project.

The work shall be performed in conformance with the stages of construction shown on the plans. Nonconflicting work in subsequent stages may proceed concurrently with work in preceding stages, provided satisfactory progress is maintained in the preceding stages of construction.

In each stage, after completion of the preceding stage, the first order of work shall be the removal of existing pavement delineation as directed by the Engineer. Pavement delineation removal shall be coordinated with new delineation so that lane lines are provided at all times on traveled ways open to public traffic.

Before obliterating any pavement delineation (traffic stripes, pavement markings, and pavement markers) that is to be replaced on the same alignment and location, as determined by the Engineer, the pavement delineation shall be referenced by the Contractor, with a sufficient number of control points to reestablish the alignment and location of the new pavement delineation. The references shall include the limits or changes in striping pattern, including one- and 2-way barrier lines, limit lines, crosswalks and other pavement markings. Full compensation for referencing existing pavement delineation shall be considered as included in the contract prices paid for new pavement delineation and no additional compensation will be allowed therefor.

Prior to applying hot mix asphalt (type B), the Contractor shall cover all manholes, valve and monument covers, grates, or other exposed facilities located within the area of application, using a plastic or oil resistant construction paper secured to the facility being covered by tape or adhesive. The covered facilities shall be referenced by the Contractor, with a sufficient number of control points to relocate the facilities after the hot mix asphalt (type B) has been placed. After completion of the hot mix asphalt (type B) operation, all covers shall be removed and disposed of in a manner satisfactory to the Engineer. Full compensation for covering manholes, valve and monument covers, grates, or other exposed facilities, referencing, and removing temporary cover shall be considered as included in the contract price paid per ton for hot mix asphalt (type B), and no additional compensation will be allowed therefor.

Construction of the new structural section adjacent to the existing traveled way shall be performed in successive and, once all operations are under way, concurrent operations of excavating, preparing subgrade, placing base materials and paving. Excavation within 8 feet of the existing traveled way shall not precede the paving operation by more than 8 working days unless:

- A. Approved in writing by the Engineer and;
- B. Material is placed and compacted against the vertical cuts within 8 feet of the existing traveled way. During excavation operations, native material may be used for this purpose, however, once the placing of the structural section commences, structural material shall be used. The material shall be placed to the level of the elevation of the top of existing pavement and tapered at a slope of 4:1 (horizontal:vertical) or flatter to the bottom of the excavation. Full compensation for placing the material on a 4:1 (horizontal:vertical) slope, regardless of the number of times it is required, and subsequent removing or reshaping of the material to the lines and grades shown on the plans shall be considered as included in the contract price paid for the materials involved and no additional compensation will be allowed therefor. No payment will be made for material placed in excess of that required for the structural section.

At those locations exposed to public traffic where guard railings, sign foundations, or sign structures are to be constructed, reconstructed, or removed, the Contractor shall schedule operations so that at the end of each working day there shall be no holes open nor shall there be any railing or posts installed without the blocks and rail elements assembled and mounted thereon.

At least 60 days before planting the plants, furnish the Engineer a statement from the vendor that the order for the plants required for this contract, including inspection plants, has been received and accepted by the vendor. The statement from the vendor must include the names, sizes, and quantities of plants ordered and the anticipated date of delivery.

Place orders for replacement plants with the vendor at the appropriate time so that the roots of the replacement plants are not in a root-bound condition.

At least 60 days before applying seeds, furnish the Engineer a statement from the vendor that the order for the seed required for this contract has been received and accepted by the vendor. The statement from the vendor must include the names and quantity of seed ordered and the anticipated date of delivery.

Unless otherwise shown on the plans or specified in these special provisions, conduits to be jacked or drilled or installed by the open trench method for water line crossovers and sprinkler control crossovers must be installed before the installation of other pipe supply lines.

When embankment settlement periods or surcharge embankment settlement periods are specified, the settlement periods and the deferment of portions of the work shall comply with the provisions in Section 19-6.025, "Settlement Period," of the Standard Specifications and in "Earthwork" of these special provisions.

## **10-1.02 WATER POLLUTION CONTROL**

### **GENERAL**

#### **Summary**

Discharges of storm water from the project must comply with NPDES General Permit for "Storm Water Discharges Associated with Construction and Land Disturbance Activities" (Order No. 2009-0009-DWQ, NPDES No. CAS000002) hereinafter called the "Permit." Manage work activities to reduce the discharge of pollutants to surface waters, groundwater, or municipal separate storm sewer systems including work items shown in the Bid Item List for:

1. Prepare Storm Water Pollution Prevention Plan. SWPPP preparation includes obtaining SWPPP approval, amending the SWPPP, preparing a CSMP and a SAP, and monitoring and inspecting WPC practices at the job site.
2. Storm Water Annual Report. Storm Water Annual Report preparation includes certifications, monitoring and inspection results, and obtaining Storm Water Annual Report acceptance.
3. Storm Water Sampling and Analysis Day. Storm Water Sampling and Analysis Day includes reporting of storm water quality per qualifying rain event. If specified for the risk level, the work includes preparation, collection, analysis, and reporting of storm water samples for turbidity, pH, and other constituents.
4. Rain Event Action Plan. If specified for the project risk level, REAP preparation includes preparing and submitting REAP forms and monitoring weather forecasts.

Do not start work until:

1. SWPPP is approved.
2. WDID is issued.
3. SWPPP review requirements have been fulfilled. If the RWQCB requires time for SWPPP review, allow 30 days for the RWQCB to review the SWPPP as specified under "Submittals" of these special provisions.

This project is Risk Level 2.

### **Definitions and Abbreviations**

**active and inactive areas:** (1) Active areas have soil disturbing work activities occurring at least once within 14 days, and (2) Inactive areas are areas that have not been disturbed for at least 15 days.

**BMPs:** Best Management Practices are water pollution control practices.

**construction phase:** Construction phases are (1) Highway Construction including work activities for building roads and structures, (2) Plant Establishment including maintenance on vegetation installed for final stabilization, and (3) Suspension where work activities are suspended and areas are inactive.

**CSMP:** Construction Site Monitoring Program.

**NAL:** Numeric Action Level.

**NEL:** Numeric Effluent Limit.

**NPDES:** National Pollutant Discharge Elimination System.

**NOI:** Notice of Intent.

**normal working hours:** The hours you normally work on this project.

**Preparation Manual:** The Department's "Storm Water Pollution Prevention Plan and Water Pollution Control Program Preparation Manual."

**QSD:** Qualified SWPPP Developer.

**QSP:** Qualified SWPPP Practitioner.

**qualified rain event:** A qualified rain event is a storm that produces at least 0.5 inch of precipitation with a 48 hour or greater period between storms.

**REAP:** Rain Event Action Plan.

**RWQCB:** Regional Water Quality Control Board.

**SAP:** Sampling and Analysis Plan.

**SSC:** Suspended Sediment Concentration.

**SWRCB:** State Water Resources Control Board.

**SWPPP:** Storm Water Pollution Prevention Plan.

**WDID:** Waste Discharge Identification Number.

**WPC:** Water Pollution Control.

**WPC Manager:** Water Pollution Control Manager. The WPC Manager implements water pollution control work described in the SWPPP and oversees revisions and amendments to the SWPPP.

### **Submittals**

Within 20 days after contract approval, start the following process for SWPPP approval:

1. Submit 3 copies of the SWPPP and allow 20 days for the Engineer's review. If revisions are required, the Engineer provides comments and specifies the date that the review stopped.
2. Change and resubmit the SWPPP within 15 days of receipt of the Engineer's comments. The Engineer's review resumes when the complete SWPPP is resubmitted.
3. When the Engineer approves the SWPPP, submit an electronic and 4 printed copies of the approved SWPPP.
4. If the RWQCB reviews the approved SWPPP, the Engineer submits one copy of the approved SWPPP to the RWQCB for their review and comment. RWQCBs requiring time to review SWPPPs include:
  - 4.1. Lahontan for projects in the Lake Tahoe Hydrologic Unit and the Mammoth Lakes Hydrologic Unit
5. If the Engineer requests changes to the SWPPP based on RWQCB comments, amend the SWPPP within 10 days.

Submit:

1. Storm water training records including training dates and subjects for employees and subcontractors. Include dates and subjects for ongoing training, including tailgate meetings.
2. Employee training records:
  - 2.1. Within 5 days of SWPPP approval for existing employees
  - 2.2. Within 5 days of training for new employees
  - 2.3. At least 5 days before subcontractors start work for subcontractor's employees

Prepare a Storm Water Annual Report for the reporting period from July 1st to June 30th. For the prior reporting period, submit the report no later than July 15th if construction occurs from July 1st through June 30th or within 15 days after contract acceptance if construction ends before June 30th.

Submit the Storm Water Annual Report as follows:

1. Submit 2 copies of the Storm Water Annual Report and allow 10 days for the Engineer's review. If revisions are required, the Engineer provides comments and specifies the date that the review stopped.
2. Change and resubmit the Storm Water Annual Report within 5 days of receipt of the Engineer's comments. The Engineer's review resumes when the complete Storm Water Annual Report is resubmitted.
3. When the Engineer accepts the Storm Water Annual Report, insert the WPC Manager's signed certification and the Engineer's signed certification.

Submit one electronic copy and 2 printed copies of the accepted Storm Water Annual Report.

Submit as required:

1. NAL Exceedance Reports
2. NEL Exceedance Reports
3. Visual Monitoring Reports
4. Inspection Reports
5. BMP Status Report

At least 5 days before operating any construction support facility, submit:

1. A plan showing the location and quantity of WPC practices associated with the construction support facility
2. A copy of the NOI approved by the RWQCB and the SWPPP approved by the RWQCB if you will be operating a batch plant or a crushing plant under the General Industrial Permit

## **Quality Control and Assurance**

### **Training**

Provide storm water training for:

1. Project managers
2. Supervisory personnel
3. Employees involved with WPC work

Train all employees, including subcontractor's employees, in the following subjects:

1. WPC rules and regulations
2. Implementation and maintenance for:
  - 2.1. Temporary Soil Stabilization
  - 2.2. Temporary Sediment Control
  - 2.3. Tracking Control
  - 2.4. Wind Erosion Control
  - 2.5. Material pollution prevention and control
  - 2.6. Waste management
  - 2.7. Non-storm water management
  - 2.8. Identifying and handling hazardous substances
  - 2.9. Potential dangers to humans and the environment from spills and leaks or exposure to toxic or hazardous substances

Employees must receive initial WPC training before working on the job site.

Conduct weekly training meetings covering:

1. WPC BMP deficiencies and corrective actions
2. BMPs that are required for work activities during the week
3. Spill prevention and control
4. Material delivery, storage, use, and disposal
5. Waste management
6. Non-storm water management procedures

Training for personnel to collect water quality samples must include:

1. SAP review
2. Health and safety review
3. Sampling simulations

If you operate construction support facilities, protect storm water systems or receiving waters from the discharge of potential pollutants by using WPC practices.

Construction support facilities include:

1. Staging areas
2. Storage yards for equipment and materials
3. Mobile operations
4. Batch plants for PCC and HMA
5. Crushing plants for rock and aggregate
6. Other facilities installed for your convenience such as haul roads

If you operate a batch plant to manufacture PCC, HMA, or other material; or a crushing plant to produce rock or aggregate; obtain coverage under the General Industrial General Permit. You must be covered under the General Industrial Permit for batch plants and crushing plants located:

1. Outside of the job site
2. Within the job site that serve one or more contracts

Discharges from manufacturing facilities such as batch plants must comply with the general waste discharge requirements for Order No. 97-03-DWQ, NPDES General Permit No. CAS000001, issued by the SWRCB for "Discharge of Stormwater Associated with Industrial Activities Excluding Construction Activities." For the General Industrial Permit, go to:

<http://www.waterboards.ca.gov/>

You may obtain copies of the Preparation Manual from the Publication Distribution Unit. The mailing address for the Publication Distribution Unit is:

State of California  
Department of Transportation  
Publication Distribution Unit  
1900 Royal Oaks Drive  
Sacramento, California 95815  
Telephone: (916) 445-3520

The Preparation Manual and other WPC references are available at the Department's "Construction Storm Water and Water Pollution Control" Web site. For the Web site, go to:

<http://www.dot.ca.gov/hq/construc/stormwater/stormwater1.htm>

#### **Water Pollution Control Manager**

Assign one WPC Manager to implement the SWPPP. The WPC Manager must comply with the Permit qualifications for a QSP and a QSD. You may assign a different QSD to prepare the SWPPP.

The QSD must have the following qualifications:

1. Department approved storm water management training described in the Department's "Construction Storm Water and Water Pollution Control" web site
2. Registration or certification described in the Permit

The QSP must meet the qualifications of the QSD or have the following certifications:

1. Department approved storm water management training described in the Department's "Construction Storm Water and Water Pollution Control" web site
2. Certification described in the Permit

At the job site, the WPC Manager must:

1. Be responsible for WPC work
2. Be the primary contact for WPC work
3. Oversee the maintenance of WPC practices
4. Oversee and enforce hazardous waste management practices
5. Have the authority to mobilize crews to make immediate repairs to WPC practices
6. Ensure that all employees have current water pollution control training
7. Implement the approved SWPPP and amend the SWPPP when required

WPC Manager must oversee:

1. Inspections of WPC practices identified in the SWPPP
2. Inspections and reports for visual monitoring
3. Preparation and implementation of REAPs
4. Sampling and analysis
5. Preparation and submittal of:
  - 5.1. NAL exceedance reports
  - 5.2. NEL exceedance reports
  - 5.3. SWPPP annual certification
  - 5.4. Annual reports
  - 5.5. BMP status reports

## **STORM WATER POLLUTION PREVENTION PLAN (SWPPP)**

### **General**

SWPPP work includes preparing a SWPPP including a CSMP, obtaining SWPPP approval, amending the SWPPP, inspecting and reporting on WPC practices at the job site. The SWPPP must comply with the Preparation Manual and the Permit. The SWPPP must be submitted in place of the water pollution control program under Section 7-1.01G, "Water Pollution," of the Standard Specifications.

You may request, or the Engineer may order, changes to the WPC work. Changes may include the addition of new WPC practices. Additional WPC work will be paid for as extra work under Section 4-1.03D, "Extra Work," of the Standard Specifications.

The SWPPP must include sections as specified for the project risk level as follows:

1. For risk level 1:
  - 1.1. Schedule
  - 1.2. CSMP
2. For risk level 2:
  - 2.1. Schedule
  - 2.2. CSMP
  - 2.3. Adherence to Effluent Standards for NALs
  - 2.4. REAP
3. For risk level 3:
  - 3.1. Schedule
  - 3.2. CSMP
  - 3.3. Adherence to Effluent Standards for NALs and NELs
  - 3.4. REAP

The SWPPP must include WPC practices for:

1. Storm water and non-stormwater from areas outside of the job site related to project work activities such as:
  - 1.1. Staging areas
  - 1.2. Storage yards
  - 1.3. Access roads
2. Activities or mobile operations related to contractor obtained NPDES permits
3. Construction support facilities

The SWPPP must include a copy of permits obtained by the Department such as Fish & Game permits, US Army Corps of Engineers permits, RWQCB 401 Certifications, and RWQCB Waste Discharge Requirements for Aerially Deposited Lead Reuse.

Amend the SWPPP annually and resubmit it by July 15th.

Amend the SWPPP if:

1. Changes in work activities could affect the discharge of pollutants
2. WPC practices are added by change order work
3. WPC practices are added at your discretion
4. Changes in the amount of disturbed soil are substantial
5. Objectives for reducing or eliminating pollutants in storm water discharges have not been achieved
6. There is a Permit violation

Whenever you amend the SWPPP, follow the same process specified for SWPPP approval.

Retain a printed copy of the approved SWPPP at the job site.

#### **SWPPP Schedule**

The SWPPP schedule must:

1. Describe when work activities will be performed that could cause the discharge of pollutants into storm water
2. Describe WPC practices associated with each construction phase
3. Identify soil stabilization and sediment control practices for disturbed soil areas

#### **Construction Site Monitoring Program (CSMP)**

##### **General**

The QSD must prepare a CSMP as part of the SWPPP. The CSMP must be developed before starting work and be revised to reflect current construction activities as necessary.

The CSMP must include sections for the project risk level as follows:

1. For risk level 1:
  - 1.1. Visual Monitoring
  - 1.2. SAP for Non-Visible Pollutants
2. For risk level 2:
  - 2.1. Visual Monitoring
  - 2.2. SAP for Non-Visible Pollutants
  - 2.3. SAP for sediment and turbidity
  - 2.4. SAP for pH
3. For risk level 3:
  - 3.1. Visual Monitoring
  - 3.2. SAP for Non-Visible Pollutants
  - 3.3. SAP for sediment and turbidity

- 3.4. SAP for pH
- 3.5. SAP for receiving waters
- 3.6. SAP for temporary active treatment systems

### **Visual Monitoring**

The WPC Manager must oversee the performance of visual inspections for qualifying rain events.

For each qualifying rain event, perform visual inspections and record observations during normal working hours as follows:

1. Record the time, date, and rain gauge reading
2. Observe:
  - 2.1. Within 2 days before the storm:
    - 2.1.1. Drainage areas for spills, leaks, or uncontrolled pollutants
    - 2.1.2. Proper implementation of WPC practices
    - 2.1.3. Storm water storage areas for leaks and adequate freeboard
  - 2.2. Every 24 hours during the storm:
    - 2.2.1. WPC practices for effective operation
    - 2.2.2. WPC practices needing maintenance and repair
  - 2.3. Within 2 days after the storm event:
    - 2.3.1. Discharge locations
    - 2.3.2. WPC practices to evaluate the design, implementation, and effectiveness
    - 2.3.3. To identify where additional WPC practices may be needed

Perform non-stormwater discharge visual inspections as follows:

1. At least once during each of the following periods:
  - 1.1. January through March
  - 1.2. April through June
  - 1.3. July through September
  - 1.4. October through December
2. Observe flowing and contained storm water for the presence of floating and suspended materials, sheen on the surface, discoloration, turbidity, odors, and sources of observed pollutants
3. Observe the job site for the presence of authorized and unauthorized non-stormwater discharges and their sources

The WPC Manager must prepare visual inspection reports that include the following:

1. Name of personnel performing the inspection, inspection date, and date inspection report completed
2. Storm and weather conditions
3. Locations and observations
4. Corrective actions taken

Maintain visual inspections reports at the job site as part of the SWPPP.

### **Sampling and Analysis Plan (SAP)**

#### **General**

Include a SAP in the CSMP to monitor the effectiveness of WPC practices.

The SAP must comply with the Preparation Manual.

Assign trained personnel to collect water quality samples. Document their training in the SAP.

Describe the following water quality sampling procedures in the SAP:

1. Sampling equipment
2. Sample preparation
3. Collection
4. Field measurement methods
5. Analytical methods
6. Quality assurance and quality control
7. Sample preservation and labeling
8. Collection documentation
9. Sample shipping
10. Chain of custody
11. Data management and reporting
12. Precautions from the construction site health and safety plan
13. Laboratory selection and certifications

Whenever assigned field personnel take samples, comply with the equipment manufacturer's recommendation for collection, analysis methods, and equipment calibration.

Samples taken for laboratory analysis must follow water quality sampling procedures and be analyzed by a State-certified laboratory under 40 CFR Part 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants."

The SAP must identify the State-certified laboratory, sample containers, preservation requirements, holding times, and analysis method. For a list of State-certified laboratories, go to:

<http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx>

Include procedure for sample collection during precipitation.

Retain water quality sampling documentation and analytical results with the SWPPP at the job site.

Show pollutant sampling locations on SWPPP drawings.

If discharges or sampling locations change because of changed work activities or knowledge of site conditions, amend the SAP.

If the project is risk level 2 or risk level 3, include procedures for collecting and analyzing at least 3 samples for each day of each qualifying rain event. Describe the collection of effluent samples at all locations where the storm water is discharged off-site.

### **Analytical Results and Evaluation**

Submit an electronic copy (in file format .xls, .txt, .csv, .dbs, or .mdb) and a printed copy of water quality analytical results, and quality assurance and quality control within 48 hours of field analysis sampling, and within 30 days for laboratory analysis. Also provide an evaluation of whether the downstream samples show levels of the tested parameter that are higher than the control sample.

Electronic water quality analysis results must have the following information:

1. Sample identification number
2. Contract number
3. Constituent
4. Reported value
5. Analytical method
6. Method detection limit
7. Reported limit

### **SAP for Non-Visible Pollutants**

The SAP must include a description of the sampling and analysis strategy for monitoring non-visible pollutants.

The SAP must identify potential non-visible pollutants present at the job site associated with any of the following:

1. Construction materials and waste
2. Existing contamination due to historical site usage
3. Application of soil amendments, including soil stabilization materials, with the potential to change pH or contribute toxic pollutants to storm water

SWPPP drawings must show the locations planned for storage and use of potential non-visible pollutants.

The SAP must include sampling procedures for the following conditions when observed during a storm water visual inspection. For each of the following, collect at least one sample for each qualifying storm event:

1. Materials or waste containing potential non-visible pollutants that are not stored under watertight conditions
2. Materials or waste containing potential non-visible pollutants that are stored under watertight conditions, but a breach, leakage, malfunction, or spill is observed; the leak or spill has not been cleaned up before precipitation; and material or waste could discharge non-visible pollutants to surface waters or drainage system
3. Chemical applications, including fertilizer, pesticide, herbicide, methyl methacrylate concrete sealant, or non-pigmented curing compound used during precipitation or within 24 hours preceding precipitation, and could discharge pollutants to surface waters or drainage system
4. Applied soil amendments, including soil stabilization materials that could change pH levels or contribute toxic pollutants to storm water runoff and discharge pollutants to surface waters or drainage system, unless available independent test data indicates acceptable concentrations of non-visible pollutants in the soil amendment
5. Storm water runoff from an area contaminated by historical usage of the site that could discharge pollutants to surface waters or drainage systems

The SAP must provide sampling procedures and schedule for:

1. Sample collection during the first 2 hours of each rain event that generate runoff
2. Sample collection during normal working hours
3. Each non-visible pollutant source
4. Uncontaminated control sample

The SAP must identify locations for sampling downstream and control samples, and reasons for selecting those locations. Select control sample locations where the sample will not come in contact with materials, waste, or areas associated with potential non-visible pollutants or disturbed soil areas.

#### **SAP for Sediment and Turbidity**

If the project is risk level 2 or risk level 3, sample and analyze for turbidity:

Parameter	Test Method	Detection Limit (Min)	Unit
Turbidity	Field test with calibrated portable instrument	1	NTU

If the project is risk level 3 and the turbidity NEL has been exceeded, sample and analyze for SSC:

Parameter	Test Method	Detection Limit (Min)	Unit
SSC	ASTM Method D3977-97	5	Mg/L

#### **SAP for pH**

If the project is risk level 2 or risk level 3, sample and analyze for pH:

Parameter	Test Method	Detection Limit (Min)	Unit
pH	Field test with calibrated portable instrument	0.2	pH units

#### **SAP for Receiving Waters**

If the project is risk level 3, describe procedures for obtaining samples from representative and accessible locations:

1. Upstream of the discharge point
2. Downstream of the discharge point

Show receiving water sampling locations on SWPPP drawings.

If there are several discharge points, describe procedures for obtaining samples from a single upstream and a single downstream location.

### **Rain Event Action Plan (REAP)**

REAP work includes preparing and submitting REAP forms and monitoring weather forecasts. The WPC Manager must submit a REAP to protect the job site at least 48 hours before a predicted rain event.

Prepare a REAP when the National Weather Service is predicting at least a 50 percent probability of precipitation within 72 hours.

For the REAP, use approved forms and include:

1. Site location
2. Risk level
3. Contact information including 24-hour emergency phone numbers for:
  - 3.1. WPC Manager
  - 3.2. Erosion and sediment control providers or subcontractors
  - 3.3. Storm water sampling providers or subcontractors
4. Storm Information
5. Construction phase information for:
  - 5.1. Highway Construction including active and inactive areas for work activities for building roads and structures
  - 5.2. Plant Establishment including maintenance on vegetation installed for final stabilization where areas are inactive
  - 5.3. Suspension where work activities are suspended and areas are inactive
6. Construction phase information including:
  - 6.1. Construction activities
  - 6.2. Subcontractors and trades on the job site
  - 6.3. Pre-storm activities including:
    - 6.3.1. Responsibilities of the WPC Manager
    - 6.3.2. Responsibilities of the crew and crew size
    - 6.3.3. Stabilization for active and inactive disturbed soil areas
    - 6.3.4. Stockpile management
    - 6.3.5. Corrective actions taken for deficiencies identified during pre-storm visual inspection
  - 6.4. Activities to be performed during storm events including:
    - 6.4.1. Responsibilities of the WPC Manager
    - 6.4.2. Responsibilities of the crew and crew size
    - 6.4.3. BMP maintenance and repair
  - 6.5. Description of flood contingency measures

You must have the REAP onsite at least 24 hours before a predicted rain event. A printed copy of each REAP must be at the job site as part of the SWPPP.

Implement the REAP including mobilizing crews to complete activities no later than 24 hours before precipitation occurs.

### **IMPLEMENTATION REQUIREMENTS**

#### **SWPPP Implementation**

Obtain, install, and maintain a rain gauge at the job site. Observe and record daily precipitation.

Monitor the National Weather Service Forecast Office on a daily basis. For forecasts, go to:

<http://www.srh.noaa.gov/forecast>

Whenever you or the Engineer identifies a deficiency in the implementation of the approved SWPPP:

1. Correct the deficiency immediately, unless the Engineer agrees to a later date for making the correction

2. Correct the deficiency before precipitation occurs

If you fail to correct the deficiency by the agreed date or before the onset of precipitation, the Department may correct the deficiency and deduct the cost of correcting the deficiency from payment.

Continue SWPPP implementation during any temporary suspension of work activities.

Install WPC practices within 15 days or before predicted precipitation, whichever occurs first.

**Numeric Action Levels (NALs)**

If the project is risk level 2 or risk level 3, then it is subject to NALs:

Parameter	Test Method	Detection Limit (Min)	Unit	Numeric Action Level
pH	Field test with calibrated portable instrument	0.2	pH units	Lower NAL = 6.5 Upper NAL = 8.5
Turbidity	Field test with calibrated portable instrument	1	NTU	250 NTU

**Numeric Effluent Limits (NELs)**

If the project is risk level 3, then it is subject to NELs:

Parameter	Test Method	Detection Limit (Min)	Unit	Numeric Effluent Limit
pH	Field test with calibrated portable instrument	0.2	pH units	Lower NEL = 6.0 Upper NEL = 9.0
Turbidity	Field test with calibrated portable instrument	1	NTU	500 NTU

The storm event daily average for storms up to the 5-year, 24-hour storm, must not exceed the NEL for turbidity. The daily average sampling results must not exceed the NEL for pH.

**Storm Water Sampling and Analysis Day**

Storm Water Sampling and Analysis Day work includes preparation, collection, analysis, and reporting of storm water samples for turbidity, pH, and other constituents. If the project is risk level 2 or risk level 3, and there is a qualified rain event that produces runoff, comply with the project's SAP for preparation, collection, analysis, and reporting of storm water samples. Collect:

1. Samples for each non-visible pollutant source and a corresponding uncontaminated control sample
2. Samples for turbidity, pH, and other constituents as specified
3. At least 3 samples for each day of each qualifying rain event
4. Samples for all locations where the storm water is discharged off-site

Perform sample collection during:

1. First 2 hours of each qualified rain event that produces runoff
2. Normal working hours

If the project is risk level 3, obtain receiving water samples.

You are not required to physically collect samples during dangerous weather conditions such as flooding or electrical storms.

If downstream samples show increased levels, assess WPC practices, site conditions, and surrounding influences to determine the probable cause for the increase.

## **Inspection**

The WPC Manager must oversee inspections for WPC practices identified in the SWPPP:

1. Before a forecasted storm
2. After precipitation that causes site runoff
3. At 24-hour intervals during extended precipitation
4. On a predetermined schedule, a minimum of once a week

The WPC Manager must oversee daily inspections of:

1. Storage areas for hazardous materials and waste
2. Hazardous waste disposal and transporting activities
3. Hazardous material delivery and storage activities
4. WPC practices specified under "Construction Site Management" of these special provisions

The WPC Manager must use the Storm Water Site Inspection Report provided in the Preparation Manual.

The WPC Manager must prepare BMP status reports that include the following:

1. Location and quantity of installed WPC practices
2. Location and quantity of disturbed soil for the active or inactive areas

Within 24 hours of finishing the weekly inspection, the WPC Manager must submit:

1. Copy of the completed site inspection report
2. Copy of the BMP status report

## **REPORTING REQUIREMENTS**

### **Storm Water Annual Report**

Storm Water Annual Report work includes certifications, monitoring and inspection results, and obtaining Storm Water Annual Report acceptance. The WPC Manager must prepare a Storm Water Annual Report. The report must:

1. Use an approved report format
2. Include project information including description and location
3. Include storm water monitoring information including:
  - 3.1. Summary and evaluation of sampling and analysis results including laboratory reports
  - 3.2. Analytical methods, reporting units, detection limits for analytical parameters
  - 3.3. Summary of corrective actions
  - 3.4. Identification of corrective actions or compliance activities that were not implemented
  - 3.5. Summary of violations
  - 3.6. Names of individuals performing storm water inspections and sampling
  - 3.7. Logistical information for inspections and sampling including location, date, time, and precipitation
  - 3.8. Visual observations and sample collection records
4. Include documentation on training for:
  - 4.1. Individuals responsible for NPDES permit compliance
  - 4.2. Individuals responsible for BMP installation, inspection, maintenance, and repair
  - 4.3. Individuals responsible for preparing, revising, and amending the SWPPP

### **NAL Exceedance Report**

If the project is risk level 2 or risk level 3 and an effluent sample exceeds a NAL, notify the Engineer and submit a NAL Exceedance Report no later than 48 hours after the conclusion of the storm event. The report must:

1. Include the following field sampling results and inspections:
  - 1.1. Analytical methods, reporting units, and detection limits
  - 1.2. Date, location, time of sampling, visual observation and measurements
  - 1.3. Quantity of precipitation of the storm event

2. Description of BMPs and corrective actions taken to manage NAL exceedance

### **NEL Violation Report**

If the project is risk level 3 and an NEL is exceeded, notify the Engineer and submit a NEL Violation Report within 6 hours. The report must:

1. Include the following field sampling results and inspections:
  - 1.1. Analytical methods, reporting units, and detection limits
  - 1.2. Date, location, time of sampling, visual observations and measurements
  - 1.3. Quantity of precipitation of the storm event
2. Description of BMPs and corrective actions taken to manage NEL exceedance

If the project is risk level 2 or risk level 3, submit all sampling results to the Engineer no later than 48 hours after the conclusion of a storm event.

### **PAYMENT**

The contract lump sum price paid for prepare storm water pollution prevention plan includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in preparing, obtaining approval of, and amending the SWPPP and CSMP, inspecting water pollution control practices, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

For projects with 60 working days or less, payments for SWPPP are made as follows:

1. After the Engineer approves the SWPPP, the Department includes up to 75 percent of the bid item price in the monthly progress estimate
2. After contract acceptance, the Department pays for the remaining percentage of the bid item price

For projects with more than 60 working days, payments for SWPPP are made as follows:

1. After the Engineer approves the SWPPP, the Department includes up to 50 percent of the bid item price in the monthly progress estimate
2. The Department pays 40 percent of the bid item price over the life of the contract
3. After contract acceptance, the Department pays for the remaining 10 percent of the bid item

If risk level 2 or 3, the Department pays \$500 for each Rain Event Action Plan submitted. The contract unit price paid for Rain Event Action Plan includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in preparation and submittal of REAP forms, and monitoring weather forecasts as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The Department does not adjust payment for an increase or decrease in the quantity of rain event action plans submitted. Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications does not apply.

The Department pays \$2,000 for each Storm Water Annual Report submitted. The contract unit price paid for Storm Water Annual Report includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in preparation and submittal of Storm Water Annual Report as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The Department does not adjust payment for an increase or decrease in the quantity of storm water annual reports submitted. Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications does not apply.

The work to complete the final Storm Water Annual Report contract item is excluded from Section 7-1.17, "Acceptance of Contract," of the Standard Specifications.

If risk level 2 or 3, the contract unit price paid for storm water sampling and analysis day includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in preparation, collection, analysis, and reporting of storm water samples per qualifying rain event as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The Department does not adjust payment for an increase or decrease in the quantity of storm water sampling and analysis day. Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications does not apply.

You may request or the Engineer may order laboratory analysis of storm water samples. Laboratory analysis of storm water samples will be paid for as extra work under Section 4-1.03D, "Extra Work," of the Standard Specifications.

The Department does not pay for the preparation, collection, laboratory analysis, and reporting of storm water samples for non-visible pollutants if WPC practices are not implemented before precipitation or if a failure of a WPC practice is not corrected before precipitation.

The Department does not pay for implementation of WPC practices in areas outside the highway right-of-way not specifically provided for in the plans or in the special provisions.

The Department does not pay for WPC practices installed at your construction support facilities.

WPC practices for which there are separate bid items of work are measured and paid for as those bid items of work.

For each failure to submit a completed Storm Water Annual Report, the Department withholds \$10,000. This withhold is in addition to other withholds under Section 9-1.07E(3) "Performance Failure Withholds," of the Standard Specifications.

Each failure to comply with any part of these special provisions and each failure to implement water pollution control practices are considered separate performance failures.

### **10-1.03 CONSTRUCTION SITE MANAGEMENT**

#### **GENERAL**

##### **Summary**

This work includes controlling potential sources of water pollution before they come in contact with storm water systems or watercourses.

Control material pollution and manage waste and non-stormwater at the job site by implementing effective handling, storage, use, and disposal practices.

For information on documents specified in these special provisions, refer to the Department's Preparation Manual, Dewatering Guide, and BMP Manual.

Preparation Manual, Dewatering Guide, and BMP Manual are available from the Department's Construction Storm Water and Water Pollution Control web site at:

<http://www.dot.ca.gov/hq/construc/stormwater/stormwater1.htm>

##### **Definitions and Abbreviations**

**active and inactive areas:** (1) Active areas have soil disturbing work activities occurring at least once within 14 days, and (2) Inactive areas are areas that have not been disturbed for at least 15 days.

**BMP Manual:** The Department's Construction Site Best Management Practices (BMP) Manual.

**CDPH:** California Department of Public Health

**Dewatering Guide:** The Department's Field Guide to Construction Site Dewatering.

**ELAP:** Environmental Laboratory Accreditation Program

**minor spills:** Small quantities of oil, gasoline, paint, or other material that are small enough to be controlled by a first responder upon discovery of the spill.

**MSDS:** Material Safety Data Sheet

**Preparation Manual:** The Department's Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual.

**semi-significant spills:** Spills that can be controlled by a first responder with help from other personnel.

**significant or hazardous spills:** Spills that cannot be controlled by construction personnel.

**WPC:** Water Pollution Control

**WPC Manager:** Water Pollution Control Manager as defined under "Water Pollution Control" of these special provisions.

##### **Submittals**

Submit the following:

1. MSDS at least 5 days before material is used or stored
2. Monthly inventory records for material used or stored
3. Copy of written approval to discharge into a sanitary sewer system at least 5 days before beginning discharge activities

##### **Quality Control and Assurance**

Not Used

##### **MATERIALS**

Not Used

## **CONSTRUCTION**

### **Spill Prevention and Control**

Implement spill and leak prevention procedures for chemicals and hazardous substances stored at the job site. If you spill or leak chemicals or hazardous substances at the job site, you are responsible for all associated cleanup costs and related liability.

As soon as it is safe, contain and clean up spills of petroleum products, sanitary and septic waste substances listed under CFR Title 40, Parts 110, 117, and 302.

#### **Minor Spills**

Clean up minor spills using the following procedures:

1. Contain the spread of the spill
2. Recover the spilled material by absorption
3. Clean the contaminated area
4. Dispose of the contaminated material promptly and properly

#### **Semi-significant Spills**

Clean up semi-significant spills immediately by the following procedures:

1. Contain the spread of the spill
2. Recover the spilled material using absorption whenever a spill occurs on a paved surface or an impermeable surface
3. Contain the spill with an earthen dike and dig up the contaminated soil for disposal whenever a spill occurs on soil
4. If the spill occurs during precipitation, cover the spill with plastic or other material to prevent contaminated runoff
5. Dispose of the contaminated material promptly and properly

#### **Significant or Hazardous Spills**

Immediately notify qualified personnel of significant or hazardous spills. Do not let construction personnel attempt to clean up the spill until qualified staff have arrived. Do the following:

1. Notify the Engineer and follow up with a written report
2. Obtain the services of a spills contractor or hazardous material team immediately
3. Notify the local emergency response team by dialing 911 and county officials at the emergency phone numbers kept at the job site
4. Notify the Governor's Office of Emergency Services Warning Center at (805) 852-7550
5. Notify the National Response Center at (800) 424-8802 regarding spills of Federal reportable quantities under CFR Title 40, Parts 110, 119, and 302
6. Notify other agencies as appropriate, including:
  - 6.1. Fire Department
  - 6.2. Public Works Department
  - 6.3. Coast Guard
  - 6.4. Highway Patrol
  - 6.5. City Police or County Sheriff Department
  - 6.6. Department of Toxic Substances
  - 6.7. California Division of Oil and Gas
  - 6.8. Cal OSHA
  - 6.9. Regional Water Resources Control Board

Report minor, semi-significant, and significant spills to the WPC Manager. The WPC Manager must notify the Engineer immediately. The WPC Manager must oversee and enforce proper spill prevention and control measures.

Prevent spills from entering storm water runoff before and during cleanup. Do not bury spills or wash spills with water.

Keep material or waste storage areas clean, well organized, and equipped with enough cleanup supplies for the material being stored.

## **Material Management**

### **General**

Material must be delivered, used, and stored for this job in a way that minimizes or eliminates discharge of material into the air, storm drain systems, and watercourses.

Implement the practices described under "Material Management" of these special provisions while taking delivery of, using, or storing any of the following materials:

1. Hazardous chemicals including acids, lime, glues, adhesives, paints, solvents, and curing compounds
2. Soil stabilizers and binders
3. Fertilizers
4. Detergents
5. Plaster
6. Petroleum materials including fuel, oil, and grease
7. Asphalt components and concrete components
8. Pesticides and herbicides

Employees trained in emergency spill cleanup procedures must be present during the unloading of hazardous materials or chemicals.

If practicable, use less hazardous materials.

### **Material Storage**

Use the following material storage procedures:

1. Store liquids, petroleum materials, and substances listed in CFR Title 40, Parts 110, 117, and 302 as specified by the Department, and place them in secondary containment facilities.
2. Secondary containment facilities must be impervious to the materials stored there for a minimum contact time of 72 hours.
3. Cover secondary containment facilities during non-working days and when precipitation is predicted. Secondary containment facilities must be adequately ventilated.
4. Keep secondary containment facility free of accumulated rainwater or spills. After precipitation, or in the event of spills or leaks, collect accumulated liquid and place into drums within 24 hours. Handle these liquids as hazardous waste under "Hazardous Waste" of these special provisions unless testing determines them to be nonhazardous.
5. Do not store incompatible materials, such as chlorine and ammonia, in the same secondary containment facility.
6. Store materials in the original containers with the original material labels maintained in legible condition. Replace damaged or illegible labels immediately.
7. Secondary containment facilities must have the capacity to contain precipitation from a 24-hour-long, 25-year storm, and 10 percent of the aggregate volume of all containers, or entire volume of the largest container within the facility, whichever is greater.
8. Store bagged or boxed material on pallets. Protect bagged or boxed material from wind and rain during non-working days and while precipitation is predicted.
9. Provide sufficient separation between stored containers to allow for spill cleanup or emergency response access. Storage areas must be kept clean, well organized, and equipped with cleanup supplies appropriate for the materials being stored.
10. Repair or replace perimeter controls, containment structures, covers, and liners as necessary. Inspect storage areas before and after precipitation, and at least weekly during other times.

### **Stockpile Management**

Use the following stockpile management procedures:

1. Reduce or eliminate potential water pollution from stockpiled material including soil, paving material, and pressure treated wood.
2. Locate stockpiles:
  - 2.1. If within the floodplain, at least 100 feet from concentrated flows of storm water, drainage courses, and inlets unless approved
  - 2.2. If outside the floodplain, at least 50 feet from concentrated flows of storm water, drainage courses, and inlets unless approved

Install WPC practices within 15 days or before predicted precipitation, whichever occurs first.  
Active and inactive soil stockpiles must be:

1. Covered with soil stabilization measures, plastic sheeting, or geosynthetic fabric
2. Surrounded with a linear sediment barrier

Portland cement concrete rubble, AC, HMA, AC and HMA rubble, aggregate base or aggregate sub-base stockpiles must be:

1. Covered with plastic sheeting, or geosynthetic fabric
2. Surrounded with a linear sediment barrier

Pressure treated wood stockpiles must be:

1. Placed on pallets
2. Covered with impermeable material

Cold mix asphalt concrete stockpiles must be:

1. Placed on impervious surface
2. Covered with impermeable material
3. Protected from run-on and runoff

Control wind erosion year round under Section 14-9.02, "Dust Control" of the Standard Specifications.

Repair or replace linear sediment barriers and covers as needed to keep them functioning properly. If sediment accumulates to 1/3 of the linear sediment barrier height, remove the sediment.

## **Waste Management**

### **Solid Waste**

Do not allow litter or debris to accumulate anywhere at the job site, including storm drain grates, trash racks, and ditch lines. Pick up and remove trash and debris from the job site at least once a week. The WPC Manager must monitor solid waste storage and disposal procedures at the job site.

If practicable, recycle nonhazardous job site waste and excess material. If recycling is not practicable, disposal must comply with Section 7-1.13, "Disposal of Material Outside the Highway Right of Way" of the Standard Specifications.

Furnish enough closed-lid dumpsters of sufficient size to contain any solid waste generated by work activities. When the refuse reaches the fill line, empty the dumpsters. Dumpsters must be watertight. Do not wash out dumpsters at the job site. Furnish additional containers and pick up dumpsters more frequent during the demolition phase of construction.

Solid waste includes:

1. Brick
2. Mortar
3. Timber
4. Metal scraps
5. Sawdust
6. Pipe
7. Electrical cuttings
8. Non-hazardous equipment parts
9. Styrofoam and other packaging materials
10. Vegetative material and plant containers from highway planting
11. Litter and smoking material, including litter generated randomly by the public
12. Other trash and debris

Furnish and use trash receptacles at the job site yard, field trailers, and locations where workers gather for lunch and breaks.

## **Hazardous Waste**

Use hazardous waste management practices if waste is generated at the job site from the following substances:

1. Petroleum products
2. Asphalt products
3. Concrete curing compound
4. Pesticides
5. Acids
6. Paints
7. Stains
8. Solvents
9. Wood preservatives and treated posts
10. Roofing tar
11. Road flares
12. Lime
13. Glues and adhesives
14. Materials classified as hazardous by California Code of Regulations, Title 22, Division 4.5; or listed in CFR Title 40, Parts 110, 117, 261, or 302

The WPC Manager must oversee and enforce hazardous waste management practices. Minimize the production of hazardous materials and hazardous waste at the job site. If damaged, repair or replace perimeter controls, containment structures, and covers.

If hazardous material levels are unknown, use a laboratory certified by ELAP under CDPH to sample and test waste to determine safe methods for storage and disposal.

Separate potentially hazardous waste from nonhazardous waste at the job site. Hazardous waste must be handled, stored, and disposed of under California Code of Regulations, Title 22, Division 4.5, Section 66262.34; and in CFR Title 49, Parts 261, 262, and 263.

Store hazardous waste in sealed containers constructed and labeled with the contents and date accumulated under California Code of Regulations, Title 22, Division 4.5; and in CFR Title 49, Parts 172, 173, 178, and 179. Keep hazardous waste containers in temporary containment facilities under "Material Storage" of these special provisions.

Furnish containers with adequate storage volume at convenient locations for hazardous waste collection. Do not overfill hazardous waste containers. Do not mix hazardous waste. Do not allow potentially hazardous waste to accumulate on the ground. Store containers of dry waste that are not watertight on pallets. Store hazardous waste away from storm drains, watercourses, moving vehicles, and equipment.

Clean water based or oil based paint from brushes or equipment within a contained area and in a way that does not contaminate soil, watercourses, and storm drain systems. Handle and dispose of the following as hazardous waste: paints, thinners, solvents, residues, and sludges that cannot be recycled or reused. When thoroughly dry, dispose of the following as solid waste: dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths.

Dispose of hazardous waste within 90 days of being generated. Use a licensed hazardous waste transporter to take hazardous waste to a Class I Disposal Site. Submit a copy of uniform hazardous waste manifest forms within 24 hours of transporting hazardous waste.

The WPC Manager must inspect the following daily:

1. Storage areas for hazardous materials and waste
2. Hazardous waste disposal and transporting activities
3. Hazardous material delivery and storage activities

## **Contaminated Soil**

Identify contaminated soil from spills or leaks by noticing discoloration, odors, or differences in soil properties. Soil with evidence of contamination must be sampled and tested by a laboratory certified by ELAP.

If levels of contamination are found to be hazardous, handle and dispose of the soil as hazardous waste.

Prevent the flow of water, including ground water, from mixing with contaminated soil by using one or a combination of the following measures:

1. Berms
2. Cofferdams
3. Grout curtains
4. Freeze walls
5. Concrete seal course

If water mixes with contaminated soil and becomes contaminated, sample and test the water using a laboratory certified by ELAP. If levels of contamination are found to be hazardous, handle and dispose of the water as hazardous waste.

### **Concrete Waste**

Use practices that will prevent the discharge of portland cement concrete, AC, or HMA waste into storm drain systems or watercourses.

Collect and dispose of portland cement concrete, AC, or HMA waste at locations where:

1. Concrete material, including grout, is used
2. Concrete dust and debris result from demolition
3. Sawcutting, coring, grinding, grooving, or hydro-concrete demolition of portland cement concrete, AC, or HMA creates a residue or slurry
4. Concrete truck or other concrete-coated equipment is cleaned at the job site

### **Sanitary and Septic Waste**

Do not bury or discharge wastewater from sanitary or septic systems within Department right-of-way. The WPC Manager must inspect sanitary or septic waste storage and monitor disposal procedures at least weekly. Sanitary facilities that discharge to the sanitary sewer system must be properly connected and free from leaks. Place sanitary facilities at least 50 feet away from storm drains, watercourses, and flow lines.

Obtain written approval from the local health agency, city, county, and sewer district before discharging from a sanitary or septic system directly into a sanitary sewer system, and submit a copy to the Engineer. Comply with local health agency provisions while using an on-site disposal system.

### **Liquid Waste**

Use practices that will prevent job site liquid waste from entering storm drain systems or watercourses. Liquid waste includes the following:

1. Drilling slurries or fluids
2. Grease-free or oil-free wastewater or rinse water
3. Dredgings, including liquid waste from drainage system cleaning
4. Liquid waste running off a surface including wash or rinse water
5. Other non-stormwater liquids not covered by separate permits

Hold liquid waste in structurally sound, leak proof containers such as:

1. Roll-off bins
2. Portable tanks

Liquid waste containers must be of sufficient quantity and volume to prevent overflow, spills and leaks.

Store containers:

1. At least 50 feet from moving vehicles and equipment
2. If within the floodplain, at least 100 feet from concentrated flows of storm water, drainage courses, watercourses, and storm drain inlets unless approved
3. If outside the floodplain, at least 50 feet from concentrated flows of storm water, drainage courses, watercourses, and storm drain inlets unless approved

Remove and dispose of deposited solids from sediment traps under "Solid Waste" of these special provisions unless the Engineer approves another method.

Liquid waste may require testing to determine hazardous material content before disposal.

Drilling fluids and residue must be disposed of outside the highway right-of-way.

If an approved location is available within the job site, fluids and residue exempt under California Code of Regulations, Title 23, Section 2511(g) may be dried by evaporation in a leak proof container. Dispose of remaining solid waste under "Solid Waste" of these special provisions.

## **Non-Storm Water Management**

### **Water Control and Conservation**

Manage water used for work activities to prevent erosion or discharge of pollutants into storm drain systems or watercourses. Obtain approval before washing anything at the job site with water that could discharge into a storm drain system or watercourse. Report discharges immediately.

If water is used at the job site, implement water conservation practices. Inspect irrigation areas. Adjust watering schedules to prevent erosion, excess watering, or runoff. Shut off water source to broken lines, sprinklers, or valves, and repair breaks within 24 hours. If possible, reuse water from waterline flushing for landscape irrigation. Sweep and vacuum paved areas; do not wash them with water.

Direct job site water runoff, including water from water line repair, to areas where it can infiltrate into the ground and not enter storm drain systems or watercourses. Do not allow spilled water to escape water truck filling areas. If possible, direct water from off-site sources around the job site. Minimize the contact of off-site water with job site water.

### **Illegal Connection and Discharge Detection and Reporting**

Inspect the job site and the site perimeter before starting work for evidence of illegal connections, discharges, or dumping. After starting work, inspect the job site and perimeter on a daily schedule.

Whenever illegal connections, discharges, or dumping are discovered, notify the Engineer immediately. Take no further action unless ordered by the Engineer. Assume unlabeled or unidentifiable material is hazardous.

Look for the following evidence of illegal connections, discharges, or dumping:

1. Debris or trash piles
2. Staining or discoloration on pavement or soils
3. Pungent odors coming from drainage systems
4. Discoloration or oily sheen on water
5. Stains or residue in ditches, channels or drain boxes
6. Abnormal water flow during dry weather
7. Excessive sediment deposits
8. Nonstandard drainage junction structures
9. Broken concrete or other disturbances near junction structures

### **Vehicle and Equipment Cleaning**

Limit vehicle and equipment cleaning or washing at the job site except what is necessary to control vehicle tracking or hazardous waste. Notify the Engineer before cleaning vehicles and equipment at the job site with soap, solvents, or steam. Contain and recycle or dispose of resulting waste under "Liquid Waste" or "Hazardous Waste" of these special provisions, whichever is applicable. Do not use diesel to clean vehicles or equipment, and minimize the use of solvents.

Clean or wash vehicles and equipment in a structure equipped with disposal facilities. If using a structure is not possible, clean or wash vehicles and equipment in an outside area. The outside area must be:

1. Paved with AC, HMA, or concrete paving
2. Surrounded by a containment berm
3. Equipped with a sump to collect and dispose of wash water
4. If within the floodplain, located at least 100 feet from concentrated flows of storm water, drainage courses, watercourses, and storm drain inlets unless approved
5. If outside the floodplain, located at least 50 feet from concentrated flows of storm water, drainage courses, watercourses, and storm drain inlets unless approved

When washing vehicles or equipment with water, use as little water as possible. Hoses must be equipped with a positive shutoff valve.

Discharge liquid from wash racks to a recycle system or to another approved system. Remove liquids and sediment as necessary.

The WPC Manager must inspect vehicle and equipment cleaning facilities:

1. Daily if vehicle and equipment cleaning occurs daily
2. Weekly if vehicle and equipment cleaning does not occur daily

### **Vehicle and Equipment Fueling and Maintenance**

If practicable, perform maintenance on vehicles and equipment off the job site.

If fueling or maintenance must be done at the job site, designate a site, or sites, and obtain approval before using. Minimize mobile fueling or maintenance.

If vehicle and equipment fueling and maintenance must be done at the job site, areas for the following activities must be:

1. On level ground
2. Protected from storm water run-on
3. If within the floodplain, located at least 100 feet from concentrated flows of storm water, drainage courses, watercourses, and storm drain inlets unless approved
4. If outside the floodplain, located at least 50 feet from concentrated flows of storm water, drainage courses, watercourses, and storm drain inlets unless approved

Use containment berms or dikes around the fueling and maintenance area. Keep adequate quantities of absorbent spill cleanup material and spill kits in the fueling and maintenance area and on fueling trucks. Dispose of spill cleanup material and kits immediately after use. Use drip pans or absorbent pads during fueling or maintenance.

Fueling or maintenance activities must not be left unattended. Fueling nozzles must be equipped with an automatic shutoff control. Vapor recovery fueling nozzles must be used where required by the Air Quality Management District. When not in use, nozzles must be secured upright. Do not top-off fuel tanks.

Recycle or properly dispose of used batteries and tires.

The WPC Manager must inspect vehicle and equipment maintenance and fueling areas:

1. Daily when vehicle and equipment maintenance and fueling occurs daily
2. Weekly when vehicle and equipment maintenance and fueling does not occur daily

The WPC Manager must inspect vehicles and equipment at the job site for leaks and spills on a daily schedule. Operators must inspect vehicles and equipment each day of use.

If leaks cannot be repaired immediately, remove the vehicle or equipment from the job site.

### **Material and Equipment Used Over Water**

Place drip pans and absorbent pads under vehicles or equipment used over water. Keep an adequate supply of spill cleanup material with the vehicle or equipment. If the vehicle or equipment will be idle for more than one hour, place drip pans or plastic sheeting under the vehicle or equipment on docks, barges, or other surfaces over water.

Furnish watertight curbs or toe boards on barges, platforms, docks, or other surfaces over water to contain material, debris, and tools. Secure material to prevent spills or discharge into water due to wind.

### **Structure Removal Over or Adjacent to Water**

Do not allow demolished material to enter storm water systems or watercourses. Use approved covers and platforms to collect debris. Use attachments on equipment to catch debris on small demolition activities. Empty debris catching devices daily and handle debris under "Waste Management" of these special provisions.

The WPC Manager must inspect demolition sites within 50 feet of storm water systems or watercourses daily.

### **Paving, Sealing, Sawcutting, Grooving, and Grinding Activities**

Prevent the following materials from entering storm drain systems or water courses:

1. Cementitious material
2. Asphaltic material
3. Aggregate or screenings
4. Grinding grooving, or sawcutting residue
5. Pavement chunks
6. Shoulder backing
7. Methacrylate

Cover drainage inlets and use linear sediment barriers to protect downhill watercourses until paving, sealing, sawcutting, grooving, or grinding activities are completed and excess material has been removed. Cover drainage inlets and manholes during the application of seal coat, tack coat, slurry seal, or fog seal.

If precipitation is predicted, limit paving, sawcutting, and grinding to places where runoff can be captured.

Do not start seal coat, tack coat, slurry seal, or fog seal activities if precipitation is predicted during the application or curing period. Do not excavate material from existing roadways during precipitation.

Use a vacuum to remove slurry immediately after slurry is produced. Do not allow slurry to run onto lanes open to traffic or off the pavement.

Collect residue from portland cement concrete grinding and grooving activities with a vacuum attachment on the grinding machine. Do not leave any residue on the pavement or allow the residue to flow across the pavement.

If approved, material excavated from existing roadways may be stockpiled under "Stockpile Management" of these special provisions.

Do not coat asphalt trucks and equipment with substances that contain soap, foaming agents, or toxic chemicals.

When paving equipment is not in use, park over drip pans or plastic sheeting with absorbent material to catch drips.

### **Thermoplastic Striping and Pavement Markers**

Thermoplastic striping and preheating equipment shutoff valves must work properly at all times. Do not preheat, transfer, or load thermoplastic within 50 feet of drainage inlets or watercourses. Do not fill a preheating container above a level that is 6 inches below the top. Truck beds must be cleaned daily of scraps or melted thermoplastic.

Do not unload, transfer, or load bituminous material for pavement markers within 50 feet of drainage inlets or watercourses. Release all pressure from a melting tank before removing the lid to fill or service. Do not fill a melting tank above a level that is 6 inches below the top.

Collect bituminous material from the roadway after marker removal.

### **Pile Driving**

Keep spill kits and cleanup material at pile driving locations. Pile driving equipment must be parked over drip pans, absorbent pads, or plastic sheeting with absorbent material. If precipitation is predicted, protect pile driving equipment by parking on plywood and covering with plastic.

Store pile driving equipment when not in use. Stored pile driving equipment must be:

1. Kept on level ground
2. Protected from storm water run-on
3. If within the floodplain, at least 100 feet from concentrated flows of storm water, drainage courses, watercourses, and storm drain inlets unless approved
4. If outside the floodplain, at least 50 feet from concentrated flows of storm water, drainage courses, watercourses, and storm drain inlets unless approved

If practicable, use vegetable oil instead of hydraulic fluid.

The WPC Manager must inspect the pile driving area for leaks and spills:

1. Daily when pile driving occurs daily
2. Weekly when pile driving does not occur daily

### **Concrete Curing**

Do not overspray chemical curing compound. Minimize the drift by spraying as close to the concrete as possible. Cover drainage inlets before applying the curing compound.

Minimize the use and discharge of water by using wet blankets or similar methods to maintain moisture while curing concrete.

### **Concrete Finishing**

Collect and dispose of water and solid waste from high-pressure water blasting. Cover drainage inlets within 50 feet before sandblasting. Minimize drift of dust and blast material by keeping the nozzle close to the surface of the concrete. The blast residue may contain hazardous material.

Inspect concrete finishing containment structures for damage before each day of use and before predicted precipitation. Remove liquid and solid waste from containment structures after each work shift.

### **Sweeping**

Sweeping must be done using hand or mechanical methods such as vacuuming.

Monitor paved areas and roadways within the job site for sediment and debris generating activities such as:

1. Clearing and grubbing
2. Earthwork
3. Trenching
4. Roadway structural section work

5. Vehicles entering and leaving the job site
6. Soil disturbing work
7. Work that causes offsite tracking of material

If sediment or debris is observed, perform sweeping:

1. Within:
  - 1.1. 8 hours of predicted rain
  - 1.2. 24 hours unless the Engineer approves a longer period
2. On paved roads at job site entrances and exit locations
3. On paved areas within the job site that flow to storm drains or receiving waters

You may stockpile collected material at the job site. Remove collected material including sediment from paved shoulders, drain inlets, curbs and dikes, and other drainage areas. If stockpiled, dispose of collected material at least once per week.

You may dispose of sediment within the job site that you collected during sweeping activities. Protect disposal areas against erosion.

Remove and dispose of trash collected during sweeping under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way" of the Standard Specifications.

### **Dewatering**

Dewatering consists of discharging accumulated storm water, ground water, or surface water from excavations or temporary containment facilities.

If dewatering and discharging activities are specified under a work item such as "Temporary Active Treatment System" or "Dewatering and Discharge," perform dewatering work as specified in the section involved.

If dewatering and discharging activities are not specified under a work item and you will be performing dewatering activities, you must:

1. Submit a Dewatering and Discharge Plan under Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and "Water Pollution Control" of these special provisions at least 10 days before starting dewatering activities. The Dewatering and Discharge Plan must include:
  - 1.1. Title sheet and table of contents
  - 1.2. Description of dewatering and discharge activities detailing locations, quantity of water, equipment, and discharge points
  - 1.3. Estimated schedule for dewatering and discharge (start and end dates, intermittent or continuous)
  - 1.4. Discharge alternatives such as dust control or percolation
  - 1.5. Visual monitoring procedures with inspection log
2. Conduct dewatering activities under the Departments' s "Field Guide for Construction Dewatering."
3. Ensure that any dewatering discharge does not cause erosion, scour, or sedimentary deposits that could impact natural bedding materials.
4. Discharge the water within the project limits. Dispose of the water in the same way as specified for material in Section 7-1.13 "Disposal of Material Outside the Highway Right of Way" of the Standard Specification if it cannot be discharged within project limits due to site constraints.
5. Do not discharge storm water or non-stormwater that has an odor, discoloration other than sediment, an oily sheen, or foam on the surface. Notify the Engineer immediately upon discovering any such condition.

The WPC manager must inspect dewatering activities:

1. Daily when dewatering work occurs daily
2. Weekly when dewatering work does not occur daily

## **PAYMENT**

The contract lump sum price paid for construction site management includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in spill prevention and control, material management, waste management, non-stormwater management, and dewatering and identifying, sampling, testing, handling, and disposing of hazardous waste resulting from your activities, as specified in the Standard Specifications and these special provisions, and as ordered by the Engineer.

### **10-1.04 STREET SWEEPING**

#### **GENERAL**

##### **Summary**

This work includes street sweeping.

The SWPPP must describe and include the use of street sweeping as a water pollution control practice for sediment control and tracking control.

##### **Submittals**

At least 5 business days before starting clearing and grubbing, earthwork, or other activities with the potential for tracking sediment or debris, submit:

1. Number of sweepers described in the SWPPP
2. Type of sweeper technology

##### **Quality Control and Assurance**

Retain and submit records of street sweeping including:

1. Quantity of sweeping waste disposal
2. Sweeping times and locations

#### **CONSTRUCTION**

##### **Street Sweepers**

Sweepers must use one of these technologies:

1. Mechanical sweeper followed by a vacuum-assisted sweeper
2. Vacuum-assisted dry (waterless) sweeper
3. Regenerative-air sweeper

##### **Operation**

Street sweeping must be done at:

1. Paved roads at job site entrance and exit locations
2. Paved areas within the job site that flow to storm drains or water bodies

Street sweeping must be done:

Street sweeping must be done:

1. During clearing and grubbing activities
2. During earthwork activities
3. During trenching activities
4. During roadway structural section activities
5. When vehicles are entering and leaving the job site
6. After soil disturbing activities
7. After observing offsite tracking of material

Monitor paved areas and roadway within the jobsite. Street sweeping must be done:

1. Within 1 hour, if sediment or debris is observed during activities that require sweeping
2. Within 24 hours, if sediment or debris is observed during activities that do not require sweeping

At least 2 sweeper must be on the job site at all times when sweeping work is required. The sweeper must be in good working order.

Perform street sweeping to minimize dust. If dust generation is excessive or sediment pickup is ineffective, use water or a vacuum.

You may stockpile collected material on the jobsite according to the approved SWPPP. Dispose of collected material at least once per week.

Material collected during street sweeping must be removed and disposed of under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Your WPCM must inspect paved roads at job site access points:

1. Daily if earthwork and other sediment or debris generating activities occur daily
2. Weekly if earthwork and other sediment or debris generating activities do not occur daily
3. When the National Weather Service predicts precipitation with a probability of at least 30 percent

### **MEASUREMENT AND PAYMENT**

The contract lump sum price paid for street sweeping includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in street sweeping, including disposal of collected material, as shown on the plans, as specified in the Standard Specifications, these special provisions, and as directed by the Engineer.

### **10-1.05 TEMPORARY HYDRAULIC MULCH (BONDED FIBER MATRIX)**

#### **GENERAL**

##### **Summary**

This work includes applying, maintaining, and removing temporary hydraulic mulch (bonded fiber matrix). Hydraulic mulch uses a mixture of fiber, tackifier, and water to stabilize active and nonactive disturbed soil areas.

The SWPPP must describe and include the use of temporary hydraulic mulch (bonded fiber matrix) as a water pollution control practice for soil stabilization.

##### **Submittals**

At least 5 business days before applying hydraulic mulch, submit:

1. Material Safety Data Sheet for the tackifier.
2. Product label describing the tackifier as an erosion control product.
3. List of pollutant indicators and potential pollutants for the use of temporary hydraulic mulch. Pollutant indicators are described under "Sampling and Analysis Plan for Non-Visible Pollutants" in the Preparation Manual.
4. Determination of acute and chronic toxicity for aquatic organisms conforming to EPA methods for the tackifier.
5. Composition of ingredients including chemical formulation.

Submit a Certificate of Compliance as specified in Section 6-1.07, "Certificates of Compliance" of the Standard Specifications for:

1. Tackifier
2. Fiber

##### **Quality Control and Assurance**

Retain and submit records of temporary hydraulic mulch applications including:

1. Compliance with specified rates
2. Application area
3. Application time
4. Quantity

### **MATERIALS**

#### **Tackifier**

The tackifier must be:

1. Nonflammable
2. Nontoxic to aquatic organisms
3. Free from growth or germination inhibiting factors
4. Bonded to the fiber or prepackaged with the fiber by the manufacturer
5. At least 10 percent of the weight of the dry fiber and include the weight of the activating agents and additives
6. Organic, high viscosity colloidal polysaccharide with activating agents, or a blended hydrocolloid-based binder

**Fiber**

Fiber must be:

1. Long strand, whole wood fibers, thermo-mechanically processed from clean, whole wood chips
2. Not made from sawdust, cardboard, paper, or paper byproducts
3. At least 25 percent of fibers 3/8 inch long
4. At least 50 percent held on a No. 25 sieve
5. Free from lead paint, printing ink, varnish, petroleum products, seed germination inhibitors, or chlorine bleach
6. Free from synthetic or plastic materials
7. At most 7 percent ash

**Coloring Agent**

Use a biodegradable nontoxic coloring agent free from copper, mercury, and arsenic to ensure the hydraulic mulch contrasts with the application area.

**CONSTRUCTION**

**Application**

Apply temporary hydraulic mulch when an area is ready to receive temporary erosion control under "Move-in/Move-out (Temporary Erosion Control)."

Dilute hydraulic mulch with water to spread the mulch evenly.

Use hydroseeding equipment to apply hydraulic mulch.

Apply hydraulic mulch:

1. In the proportions indicated in the table below. Successive applications or passes may be needed to achieve the required proportion rate:

Material	Application Rate lbs/acre
Bonded Fiber (includes fiber and tackifier material)	4,500

2. To form a continuous mat with no gaps between the mat and the soil surface.
3. From 2 or more directions to achieve a continuous mat.
4. In layers to avoid slumping and to aid drying.
5. During dry weather or at least 24 hours before predicted rain.

Do not apply hydraulic mulch if:

1. Water is standing on or moving across the soil surface
2. Soil is frozen
3. Air temperature is below 40 °F during the tackifier curing period unless allowed by the tackifier manufacturer and approved by the Engineer

Do not over-spray hydraulic mulch onto the traveled way, sidewalks, lined drainage channels, or existing vegetation.

**Maintenance**

Reapply hydraulic mulch within 24 hours of discovering visible erosion unless the Engineer approves a longer period.

## **Removal**

Remove hydraulic mulch by mechanically blending it into the soil with track laying equipment, disking, or other approved method.

Temporary hydraulic mulch disturbed or displaced by your vehicles, equipment, or operations must be reapplied at your expense.

Cleanup, repair, removal, disposal, or replacement due to improper installation or your negligence are not included in the cost for performing maintenance.

## **MEASUREMENT AND PAYMENT**

Temporary hydraulic mulch (bonded fiber matrix) is measured by the square yard from measurements along the slope of the areas covered by the hydraulic mulch.

The contract price paid per square yard for temporary hydraulic mulch (bonded fiber matrix) includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in applying temporary hydraulic mulch, complete in place, including removal of hydraulic mulch, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The State and you share the cost of maintaining the temporary hydraulic mulch. The State determines the maintenance cost under Section 9-1.03, "Force Account Payment," of the Standard Specifications and pays you one-half of that cost.

### **10-1.06 TEMPORARY CORRUGATED STEEL PIPE RISER**

Temporary corrugated steel pipe risers shall conform to the provisions in Section 70, "Miscellaneous Facilities," of the Standard Specifications and these special provisions.

Temporary corrugated steel pipe risers shall be furnished, installed, and maintained, as shown on the plans, and as directed by the Engineer.

Used materials shall not be installed.

Excavation and backfill for temporary corrugated steel pipe risers shall be performed in a manner that will provide adequate support for the pipe below with a firm, and nonsettling foundation for the roadbeds to be constructed over the pipe.

Temporary corrugated steel pipe risers and reducing elbow that are damaged from any cause during the progress of the work shall be repaired or replaced by the Contractor at the Contractor's expense.

Temporary bituminous coated corrugated steel pipe risers will be measured and paid for by the linear foot for the sizes of temporary corrugated steel pipe risers shown on the plans and listed in the Engineer's Estimate in the same manner specified for corrugated steel pipe riser in Section 70-1.04, "Measurement," and Section 70-1.05, "Payment," of the Standard Specifications.

Full compensation for maintaining of temporary bituminous coated corrugated steel pipe risers shall be considered as included in the contract prices paid per linear foot of temporary bituminous coated corrugated steel pipe risers and no additional compensation will be allowed therefor.

Concrete collar and corrugated steel pipe reducing elbow installed to connect temporary corrugated steel pipe risers with other pipes shall be considered as included in the contract prices paid per linear foot of temporary bituminous coated corrugated steel pipe risers and no additional compensation will be allowed therefor.

### **10-1.07 TEMPORARY SLOTTED CORRUGATED STEEL PIPE CULVERTS**

Temporary slotted corrugated steel pipe culverts shall be furnished, installed, maintained, and later removed as shown on the plans, as specified in these special provisions and as directed by the Engineer.

Temporary slotted corrugated steel pipe shall comply with "Slotted Corrugated Steel Pipe," of these special provisions.

Used materials may be installed provided the used materials are good, sound and are suitable for the purpose intended, as determined by the Engineer.

Excavation and backfill for temporary slotted corrugated steel pipe culverts shall be performed in a manner that will provide adequate support for the slotted corrugated steel pipe culvert with a firm and nonsettling foundation. Backfill material for temporary slotted corrugated steel pipe culverts shall be structure backfill (cement treated) as provided in Section 66-3.09, "Slotted Pipe," of the Standard Specifications.

Temporary slotted corrugated steel pipe culverts that are damaged from any cause during the progress of the work shall be repaired or replaced by the Contractor at the Contractor's expense.

When no longer required for the work as determined by the Engineer, temporary slotted corrugated steel pipe culverts shall be removed. Removed facilities shall become the property of the Contractor and shall be removed from the site of the work, except as otherwise provided in this section.

Trenches and pits caused by the removal of temporary slotted corrugated steel pipe culverts shall be backfilled in conformance with the provisions in the second paragraph of Section 15-1.02, "Preservation of Property," of the Standard Specifications.

Temporary slotted corrugated steel pipe culverts will be measured and paid for by the linear foot for the sizes of temporary slotted corrugated steel pipe culverts shown on the plans and listed in the Engineer's Estimate in the same manner specified for corrugated metal pipe in Section 66-4.01, "Measurement," and Section 66-4.02, "Payment," of the Standard Specifications.

Full compensation for maintaining, removing and disposing of temporary bituminous coated slotted corrugated steel pipe culverts shall be considered as included in the contract prices paid per linear foot for the various sizes of temporary bituminous coated slotted corrugated steel pipe culverts and no additional compensation will be allowed therefore.

## **10-1.08 TEMPORARY CONCRETE WASHOUT BIN**

### **GENERAL**

#### **Summary**

This work includes removal and disposal of concrete waste by furnishing, maintaining, and removing temporary concrete washout bins.

The SWPPP must describe and include the use of temporary concrete washout bins as a water pollution control practice for waste management and materials pollution control.

#### **Submittals**

At least 5 business days before concrete operations start, submit:

1. Location of the washout bins
2. Name and location of the off-site concrete waste disposal facility to receive concrete waste
3. Copy of the permit issued by RWQCB for the off-site commercial disposal facility
4. Copy of the license for the off-site commercial disposal facility
5. Copy of the permit issued by the state or local agency having jurisdiction over the disposal facility if the disposal site is located outside of the State of California

#### **Quality Control and Assurance**

Retain and submit records of disposed concrete waste including:

1. Weight tickets
2. Delivery and removal of concrete washout bins

### **MATERIALS**

#### **Concrete Washout Bin**

Concrete washout bin must:

1. Be a commercially available watertight container
2. Have sufficient capacity to contain all liquid and concrete waste generated by washout operations without seepage or spills
3. Be not less than 5 cubic yards of capacity
4. Be a roll-off bin and may include folding steel ramps
5. Be labeled for the exclusive use as a concrete waste and washout facility

#### **Concrete Washout Sign**

Concrete washout sign must:

1. Comply with the provisions in Section 12-3.06B, "Portable Signs" of the Standard Specifications
2. Be approved by the Engineer
3. Consist of a base, framework, and a sign panel
4. Be made out of plywood
5. Be a minimum size of 2 feet by 4 feet
6. Read "Concrete Washout" with black letters, 3 inches high, on a white background

### **CONSTRUCTION**

#### **Placement**

Place concrete washout bins at the job site:

1. Before concrete placement activities begin
2. In the immediate area of the concrete work as approved by the Engineer
3. No closer than 50 feet from storm drain inlets, open drainage facilities, ESAs, or watercourses
4. Away from construction traffic or public access areas

Install a concrete washout sign adjacent to each temporary concrete washout bin location.

### **Operation**

Use concrete washout bins for:

1. Washout from concrete delivery trucks
2. Slurries containing portland cement concrete or hot mix asphalt from sawcutting, coring, grinding, grooving, and hydro-concrete demolition
3. Concrete waste from mortar mixing stations

Relocate concrete washout bins as needed for concrete construction work.

Replace concrete washout bins when filled to capacity. Do not fill higher than 6 inches below rim.

Your WPCM must inspect concrete washout bins:

1. Daily if concrete work occurs daily
2. Weekly if concrete work does not occur daily

### **Maintenance**

When relocating or transporting a concrete washout bin within the project site, secure the concrete washout bin to prevent spilling of concrete waste material. If any spilled material is observed, remove the spilled material and place it into the concrete washout bin.

### **Removal**

Dispose of concrete waste material at a facility specifically licensed to receive solid concrete waste, liquid concrete waste, or both. Remove and dispose of concrete waste within 2 days of the concrete washout bin becoming filled to capacity.

## **MEASUREMENT AND PAYMENT**

Temporary concrete washout bin is measured by the actual count of concrete washout bins in place.

The contract unit price paid for temporary concrete washout bin includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing, maintaining, and removing the concrete washout bin, including removal and disposal of concrete waste, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

### **10-1.09 TEMPORARY CHECK DAM**

#### **GENERAL**

##### **Summary**

This work includes constructing, maintaining, and removing temporary check dams.

The SWPPP must describe and include the use of temporary check dams as a water pollution control practice for soil stabilization in flow conveyances.

##### **Submittals**

Submit a Certificate of Compliance as specified in Section 6-1.07, "Certificates of Compliance" of the Standard Specifications for:

1. Gravel-filled bag fabric

#### **MATERIALS**

##### **Gravel-filled Bag Fabric**

Geosynthetic fabric for temporary gravel bag berm must consist of one of the following:

1. Polyester
2. Polypropylene
3. Combined polyester and polypropylene

Sample under ASTM D 4354, Procedure C.

Test under ASTM D 4759. All properties are based on Minimum Average Roll Value (MARV).

Identify, store, and handle under ASTM D 4873.

Protect geosynthetics from moisture, sunlight and damage during shipping and storage. Label each unit with the manufacturer's name, identifying information and product identification.

Gravel-filled bag fabric must comply with:

Specification	Requirements
Grab breaking load 1-inch grip, lb, min. in each direction	205
Apparent elongation percent, min., in each direction	50
Water Flow Rate max. average roll value, gallons per minute/square foot	80-150
Permittivity l/sec., min	1.2
Apparent opening size max. average roll value, U.S. Standard sieve size	40-80
Ultraviolet Degradation percent of original unexposed grab breaking load 500 hr, minimum	70

### **Gravel**

Gravel for gravel-filled bags must be:

1. From 3/8 to 3/4 inch in diameter
2. Clean and free from clay balls, organic matter, and other deleterious materials

### **Gravel-filled Bags**

Gravel-filled bags must:

1. Be made from gravel-filled bag fabric.
2. Have inside dimensions from 24 to 32 inches in length, and from 16 to 20 inches in width.
3. Have the opening bound to retain the gravel. The opening must be sewn with yarn, bound with wire, or secured with a closure device.
4. Weigh from 30 to 50 pounds when filled with gravel.

### **CONSTRUCTION**

Before placing temporary check dam, remove obstructions including rocks, clods, and debris greater than one inch in diameter from the ground.

If check dams are to be placed in the same areas as erosion control blankets, then install the blankets before placing the check dams.

Temporary check dams must be:

1. Placed approximately perpendicular to the centerline of the ditch or drainage line
2. Installed with sufficient spillway depth to prevent flanking of concentrated flow around the ends of the check dam
3. Type 2 for gravel-filled bags:
  - 3.1. If the ditch is lined with concrete or hot mix asphalt, use temporary check dam (Type 2)
  - 3.2. If the ditch is unlined, use temporary check dam (Type 2)

Temporary check dam (Type 2) must be:

1. Placed as a single layer of gravel bags
2. End-to-end to eliminate gaps

If you need to increase the height of the temporary check dam (Type 2):

1. Increase height by adding rows of gravel-filled bags
2. Stack bags in a way that the bags in the top row overlap the joints in the lower row
3. Stabilize dam by adding rows of bags at the bottom

## **MAINTENANCE**

Maintain temporary check dams to provide sediment holding capacity and to reduce concentrated flow velocities.

Remove sediment deposits, trash, and debris from temporary check dams as needed or when directed by the Engineer. If removed sediment is deposited within project limits, it must be stabilized and not subject to erosion by wind or water. Trash and debris must be removed and disposed of as specified in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Maintain temporary check dams by:

1. Removing sediment from behind the check dam when sediment is 1/3 the height of the check dam above ground
2. Repairing or adjusting the check dams when scour and other evidence of concentrated flow occur beneath the fiber roll
3. Repairing or replacing the gravel-filled bags when they become split, torn, or unraveled

Repair temporary check dams within 24 hours of discovering damage unless the Engineer approves a longer period.

If your vehicles, equipment, or activities disturb or displace temporary check dams, repair temporary check dams at your expense.

The Department does not pay maintenance costs for cleanup, repair, removal, disposal, or replacement due to improper installation or your negligence.

## **REMOVAL**

When the Engineer determines that temporary check dams are not required, they must be removed and disposed of under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Ground disturbance, including holes and depressions, caused by the installation and removal of the temporary check dams must be backfilled and repaired under Section 15-1.02, "Preservation of Property," of the Standard Specifications.

## **MEASUREMENT AND PAYMENT**

Temporary check dam is measured by the linear foot along the centerline of the check dams.

The contract price paid per linear foot for temporary check dams includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the temporary check dams, complete in place, including removal of materials, cleanup and disposal of retained sediment and debris, and backfilling and repairing holes, depressions and other ground disturbance, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer

The State and you share the cost of maintaining the temporary check dams. The State determines the maintenance cost under Section 9-1.03, "Force Account Payment," of the Standard Specifications and pays you one-half of that cost.

### **10-1.10 TEMPORARY FIBER ROLL**

#### **GENERAL**

##### **Summary**

This work includes constructing, maintaining, and removing temporary fiber roll.

The SWPPP must describe and include the use of temporary fiber roll as a water pollution control practice for sediment control.

##### **Submittals**

Submit a Certificate of Compliance as specified in Section 6-1.07, "Certificates of Compliance" of the Standard Specifications for fiber roll.

#### **MATERIALS**

##### **Fiber Roll**

Fiber roll must:

1. Last for at least one year after installation

2. Be Type 1 or Type 2

If specified, Type 1 fiber roll must be:

1. Made from an erosion control blanket:
  - 1.1. Classified by the Erosion Control Technology Council (ECTC) as ECTC 2D
  - 1.2. With a Universal Soil Loss Equation (USLE) C-Factor of not more than 0.20 at a 2:1 (horizontal:vertical) slope
  - 1.3. Capable to withstand a maximum shear stress of 1.75 pounds per square foot under ASTM D 6460
  - 1.4. With a minimum tensile strength of 75 pounds per foot under ASTM D 5035
  - 1.5. With top and bottom surfaces covered with extruded photodegradable plastic netting or lightweight non-synthetic netting
  - 1.6. That complies with one of the following:
    - 1.6.1. Double net straw and coconut blanket with 70 percent straw and 30 percent coconut fiber
    - 1.6.2. Double net excelsior blanket with 80 percent of the wood excelsior fibers being 6 inches or longer
2. Rolled along the width
3. Secured with natural fiber twine every 6 feet and 6 inches from each end
4. Finished to be either:
  - 4.1. From 8 to 10 inches in diameter, from 10 to 20 feet long, and at least 0.5 pounds per linear foot
  - 4.2. From 10 to 12 inches in diameter, at least 10 feet long, and at least 2 pounds per linear foot

If specified, Type 2 fiber roll must:

1. Be filled with rice or wheat straw, wood excelsior, or coconut fiber
2. Be covered with a photodegradable plastic netting or a biodegradable jute, sisal, or coir fiber netting
3. Have the netting secured tightly at each end
4. Be finished to be either:
  - 4.1. From 8 to 10 inches in diameter, from 10 to 20 feet long, and at least 1.1 pounds per linear foot
  - 4.2. From 10 to 12 inches in diameter, at least 10 feet long, and at least 3 pounds per linear foot

### **Wood Stakes**

Wood stakes must be:

1. Untreated fir, redwood, cedar, or pine and cut from sound timber
2. Straight and free of loose or unsound knots and other defects which would render the stakes unfit for use
3. Pointed on the end to be driven into the ground

For fiber roll, wood stakes must be at least:

1. 1" x 1" x 24" in size for Type 1 installation
2. 1" x 2" x 24" in size for Type 2 installation

### **Rope**

For Type 2 installation, rope must:

1. Be biodegradable, such as sisal or manila
2. Have a minimum diameter of 1/4 inch

### **CONSTRUCTION**

Before placing fiber roll, remove obstructions including rocks, clods, and debris greater than one inch in diameter from the ground.

If fiber roll is to be placed in the same area as erosion control blanket, install the blanket before placing the fiber roll. For other soil stabilization practices such as hydraulic mulch or compost, place the fiber roll and then apply the soil stabilization practice.

Place fiber roll on slopes at the following spacing unless the plans show a different spacing:

1. 10 feet apart for slopes steeper than 2:1 (horizontal:vertical)
2. 15 feet apart for slopes from 2:1 to 4:1 (horizontal:vertical)
3. 20 feet apart for slopes from 4:1 to 10:1 (horizontal:vertical)
4. 50 feet apart for slopes flatter than 10:1 (horizontal:vertical)

Place fiber roll approximately parallel to the slope contour. For any 20 foot section of fiber roll, do not allow the fiber roll to vary more than 5 percent from level.

Type 1 and Type 2 fiber roll may be installed using installation method Type 1, Type 2, or a combination:

For installation method Type 1, install fiber roll by:

1. Placing in a furrow that is from 2 to 4 inches deep
2. Securing with wood stakes every 4 feet along the length of the fiber roll
3. Securing the ends of the fiber roll by placing a stake 6 inches from the end of the roll
4. Driving the stakes into the soil so that the top of the stake is less than 2 inches above the top of the fiber roll

For installation method Type 2, install fiber roll by:

1. Securing with rope and notched wood stakes.
2. Driving stakes into the soil until the notch is even with the top of the fiber roll.
3. Lacing the rope between stakes and over the fiber roll. Knot the rope at each stake.
4. Tightening the fiber roll to the surface of the slope by driving the stakes further into the soil.

## **MAINTENANCE**

Maintain temporary fiber roll to provide sediment holding capacity and to reduce runoff velocities.

Remove sediment deposits, trash, and debris from temporary fiber roll as needed or when directed by the Engineer. If removed sediment is deposited within project limits, it must be stabilized and not subject to erosion by wind or water. Trash and debris must be removed and disposed of as specified in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Maintain temporary fiber roll by:

1. Removing sediment from behind the fiber roll when sediment is 1/3 the height of the fiber roll above ground
2. Repairing or adjusting the fiber roll when rills and other evidence of concentrated runoff occur beneath the fiber roll.
3. Repairing or replacing the fiber roll when they become split, torn, or unraveled
4. Adding stakes when the fiber roll slump or sag
5. Replacing broken or split wood stakes

Repair temporary fiber roll within 24 hours of discovering damage unless the Engineer approves a longer period.

If your vehicles, equipment, or activities disturb or displace temporary fiber roll, repair temporary fiber roll at your expense.

The Department does not pay maintenance costs for cleanup, repair, removal, disposal, or replacement due to improper installation or your negligence.

## **REMOVAL**

When the Engineer determines that temporary fiber roll is not required, they must be removed and disposed of under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Ground disturbance, including holes and depressions, caused by the installation and removal of the temporary fiber roll must be backfilled and repaired under Section 15-1.02, "Preservation of Property," of the Standard Specifications.

**MEASUREMENT AND PAYMENT**

Temporary fiber roll is measured by the linear foot along the centerline of the installed roll. Where temporary fiber roll is joined and overlapped, the overlap is measured as a single installed roll.

The contract price paid per linear foot for temporary fiber roll includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the temporary fiber roll, complete in place, including removal of materials, cleanup and disposal of retained sediment and debris, and backfilling and repairing holes, depressions and other ground disturbance, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer

The State and you share the cost of maintaining the temporary fiber roll. The State determines the maintenance cost under Section 9-1.03, "Force Account Payment," of the Standard Specifications and pays you one-half of that cost.

**10-1.11 TEMPORARY GRAVEL BAG BERM**

**GENERAL**

**Summary**

This work includes constructing, maintaining, and removing temporary gravel bag berm.

The SWPPP must describe and include the use of temporary gravel bag berm as a water pollution control practice for sediment control.

**Submittals**

Submit a Certificate of Compliance as specified in Section 6-1.07, "Certificates of Compliance" of the Standard Specifications for gravel-filled bag fabric.

**MATERIALS**

**Gravel-filled Bag Fabric**

Geosynthetic fabric for temporary gravel bag berm must consist of one of the following:

1. Polyester
2. Polypropylene
3. Combined polyester and polypropylene

Sample under ASTM D 4354, Procedure C.

Test under ASTM D 4759. All properties must be based on Minimum Average Roll Value (MARV).

Identify, store, and handle under ASTM D 4873.

Protect geosynthetics from moisture, sunlight, and damage during shipping and storage. Label each unit with the manufacturer's name, identifying information, and product identification.

Gravel-filled bag fabric must comply with:

Specification	Requirements
Grab breaking load 1-inch grip, lb, min. in each direction	205
Apparent elongation percent, min., in each direction	50
Water Flow Rate max. average roll value, gallons per minute/square foot	80-150
Permittivity 1/sec., min	1.2
Apparent opening size max. average roll value, U.S. Standard sieve size	40-80
Ultraviolet Degradation percent of original unexposed grab breaking load 500 hr, minimum	70

**Gravel**

Gravel for gravel-filled bags must be:

1. From 3/8 to 3/4 inch in diameter
2. Clean and free from clay balls, organic matter, and other deleterious materials

### **Gravel-filled Bags**

Gravel-filled bags must:

1. Be made from gravel-filled bag fabric.
2. Have inside dimensions from 24 to 32 inches in length, and from 16 to 20 inches in width.
3. Have the opening bound to retain the gravel. The opening must be sewn with yarn, bound with wire, or secured with a closure device.
4. Weigh from 30 to 50 pounds when filled with gravel.

### **CONSTRUCTION**

Before constructing temporary gravel bag berm, remove obstructions including rocks, clods, and debris greater than 1 inch in diameter from the ground.

Temporary gravel bag berm must:

1. Be placed as a single layer of gravel bags to create a linear sediment barrier
2. Be placed end-to-end to eliminate gaps
3. Be placed approximately parallel to the slope contour
4. Have the last 6 feet of the gravel bag berm angled up-slope

If you need to increase the height of the temporary gravel bag berm:

1. Increase height by adding rows of gravel-filled bags
2. Stack bags in a way that the bags in the top row overlap the joints in the lower row
3. Stabilize berm by adding rows at the bottom

If used within shoulder area, gravel-filled bags must be placed behind temporary railing (Type K).

### **MAINTENANCE**

Maintain temporary gravel bag berm to provide sediment holding capacity and to reduce runoff velocities.

Remove sediment deposits, trash, and debris from temporary gravel bag berm as needed or when directed by the Engineer. If removed sediment is deposited within project limits, it must be stabilized and not subject to erosion by wind or water. Trash and debris must be removed and disposed of as specified in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Maintain temporary gravel bag berm by:

1. Removing sediment from behind the gravel bag berm when sediment is 1/3 the height of the gravel bag berm above ground
2. Repairing or adjusting the gravel-filled bags when rills and other evidence of concentrated runoff occur beneath the gravel-filled bags
3. Repairing or replacing the gravel-filled bags when they become split, torn, or unraveled

Repair temporary gravel bag berm within 24 hours of discovering damage unless the Engineer approves a longer period.

If your vehicles, equipment, or activities disturb or displace temporary gravel bag berm, repair temporary gravel bag berm at your expense.

The Department does not pay maintenance costs for cleanup, repair, removal, disposal, or replacement due to improper installation or your negligence.

### **REMOVAL**

When the Engineer determines that temporary gravel bag berm is not required, they must be removed and disposed of under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Ground disturbance, including holes and depressions, caused by the installation and removal of the temporary gravel bag berm must be backfilled and repaired under Section 15-1.02, "Preservation of Property," of the Standard Specifications.

**MEASUREMENT AND PAYMENT**

Temporary gravel bag berm is measured by the linear foot along the centerline of the installed berm.

The contract price paid per linear foot for temporary gravel bag berm includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the temporary gravel bag berm, complete in place, including removal of materials, cleanup and disposal of retained sediment and debris, and backfilling and repairing holes, depressions and other ground disturbance, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The State and you share the cost of maintaining the temporary gravel bag berm. The State determines the maintenance cost under Section 9-1.03, "Force Account Payment," of the Standard Specifications and pays you one-half of that cost.

**10-1.12 TEMPORARY CONSTRUCTION ENTRANCE**

**GENERAL**

**Summary**

This work includes constructing, maintaining, and removing temporary construction entrance to provide temporary access.

The SWPPP must describe and include the use of temporary construction entrance as a water pollution control practice for tracking control.

Temporary construction entrance must be Type 2.

**Submittals**

Submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for:

- 1. Temporary entrance fabric
- 2. Rock

Submit details for alternatives at least 5 business days before installation. You may propose alternatives for the following items:

- 1. Alternative sump
- 2. Alternative corrugated steel panels

If the Engineer approves, you may eliminate the sump.

**MATERIALS**

**Temporary Entrance Fabric**

Temporary entrance fabric must comply with Section 88-1.04, "Rock Slope Protection Fabric," of the Standard Specifications and be woven Type B or non-woven Type B.

**Rock**

Rock must be Type B.

Rock (Type B) must be Railway Ballast Number 25. Do not use blast furnace slag. Railway Ballast Number 25 must comply with:

- 1. Description in AREMA Manual for Railway Engineering.
- 2. Following sizes:

Nominal Size Square Opening	Percentage Passing								
	3"	2-1/2"	2"	1-1/2"	1"	3/4"	1/2"	3/8"	No. 4
2-1/2"-3/8"	100	80-100	60-85	50-70	25-50	-	5-20	0-10	0-3

- 3. Following properties:

Specification	Requirements
Percent material passing No. 200 sieve, max. ASTM: C 117	1.0
Bulk specific gravity, min. ASTM: C 127	2.60
Absorption, percent min. ASTM: C 127	1.0
Clay lumps and friable particles, percent max. ASTM: C 142	0.5
Degradation, percent max. ASTM: C 535	30
Soundness (Sodium Sulfate), percent max. ASTM: C 88	5.0
Flat, elongated particles, or both, percent max. ASTM: D 4791	5.0

### **Corrugated Steel Panels**

Corrugated steel panels must:

1. Be made of steel.
2. Be pressed or shop welded
3. Have a slot or hook for connecting panels together

### **CONSTRUCTION**

Prepare location for temporary construction entrance by:

1. Removing vegetation to ground level and clear away debris
2. Grading ground to uniform plane
3. Grading ground surface to drain
4. Removing sharp objects that may damage fabric
5. Compacting the top 1.5 feet of soil to at least 90 percent relative compaction

Use Rock (Type B) under corrugated steel panels. Use at least 6 corrugated steel panels for each entrance. Couple panels together.

Install temporary construction entrance by:

1. Positioning fabric along the length of the entrance
2. Overlapping sides and ends of fabric by at least 12 inches
3. Spreading rock over fabric in the direction of traffic
4. Covering fabric with rock within 24 hours
5. Keeping a 6 inch layer of rock over fabric to prevent damage to fabric by spreading equipment

Do not drive on fabric until rock is spread.

Unless the Engineer eliminates the sump, install a sump within 20 feet of each temporary construction entrance.

Repair fabric damaged during rock spreading by placing a new fabric over the damaged area. New fabric must be large enough to cover damaged area and provide at least 18-inch overlap on all edges.

### **Maintenance**

Maintain temporary construction entrance to minimize generation of dust and tracking of soil and sediment onto public roads. If dust or sediment tracking increases, place additional rock unless the Engineer approves another method.

Repair temporary construction entrance if:

1. Fabric is exposed
2. Depressions in the entrance surface develop
3. Rock is displaced

Repair temporary construction entrance within 24 hours of discovering damage unless the Engineer approves a longer period.

During use of temporary construction entrance, do not allow soil, sediment, or other debris tracked onto pavement to enter storm drains, open drainage facilities, or watercourses. When material is tracked onto pavement, remove it within 24 hours unless the Engineer approves a longer period.

If your vehicles, equipment, or activities disturb or displace the temporary construction entrance, repair it at your expense.

The Department does not pay maintenance costs for cleanup, repair, removal, disposal, or replacement due to improper installation or your negligence.

### **Removal**

When the Engineer determines that temporary construction entrance is not required, remove and dispose of it under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Backfill and repair ground disturbance, including holes and depressions, caused by installation and removal of temporary construction entrance under Section 15-1.02, "Preservation of Property," of the Standard Specifications.

## **MEASUREMENT AND PAYMENT**

Temporary construction entrance is determined from actual count in place. Temporary construction entrance is measured one time only and no additional measurement will be recognized.

The contract price paid for temporary construction entrance includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing temporary construction entrance, complete in place, including removal of temporary construction entrance, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

No additional compensation will be made if the temporary construction entrance is relocated during the course of construction.

The State and you share the cost of maintaining temporary construction entrance. The State determines the maintenance cost under Section 9-1.03, "Force Account Payment," of the Standard Specifications and pays you one-half of that cost.

## **10-1.13 MOVE-IN/MOVE-OUT (TEMPORARY EROSION CONTROL)**

### **GENERAL**

#### **Summary**

This work includes moving onto the project when an area is ready to receive temporary erosion control, setting up required personnel and equipment for the application of erosion control materials, and moving out all personnel and equipment when temporary erosion control in that area is completed.

Temporary erosion control consists of any water pollution control practice for soil stabilization.

When notified by the Engineer that an area is ready for temporary erosion control, start erosion control work within 5 business days.

## **MEASUREMENT AND PAYMENT**

Move-in/move-out (temporary erosion control) is measured as units from actual count. A move-in followed by a move-out is considered one unit.

The contract unit price paid for move-in/move-out (temporary erosion control) includes full compensation for furnishing all labor, materials (excluding temporary erosion control materials), tools, equipment, and incidentals and for doing all the work involved in moving in and removing from the project all personnel and equipment necessary for application of temporary erosion control, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## **10-1.14 TEMPORARY DRAINAGE INLET PROTECTION**

### **GENERAL**

#### **Summary**

This work includes constructing, maintaining, and removing temporary drainage inlet protection. Drainage inlet protection settles and filters sediment before stormwater runoff discharges into storm drainage systems.

The SWPPP must describe and include the use of temporary drainage inlet protection as a water pollution control practice for sediment control.

Provide temporary drainage inlet protection to meet the changing conditions around the drainage inlet. Temporary drainage inlet protection must be:

1. Appropriate type to meet the conditions around the drainage inlet
2. Type 3A, Type 3B, or a combination

**Submittals**

Submit a Certificate of Compliance as specified in Section 6-1.07, "Certificates of Compliance" of the Standard Specifications for:

1. Erosion control blanket
2. Fiber rolls
3. Safety cap for metal posts
4. Silt fence fabric
5. Sediment filter bag
6. Foam barrier
7. Rigid plastic barrier
8. Gravel-filled bag fabric

If you substitute the steel wire staple with an alternative attachment device, submit a sample of the device for approval at least 5 business days before installation.

**MATERIALS**

**Geosynthetic Fabrics**

Geosynthetic fabrics for temporary drainage inlet protection must consist of one of the following:

1. Polyester
2. Polypropylene
3. Combined polyester and polypropylene

Geosynthetic fabrics for temporary drainage inlet must comply with the specifications for water pollution control in Section 88-1.05, "Water Pollution Control," of the Standard Specifications.

Foam barrier must comply with:

**Foam Barrier**

Property	ASTM Designation	Specification
Grab breaking load 1-inch grip, lb, min. in each direction	D 4632	200
Apparent elongation percent, min., in each direction	D 4632	15
Water Flow Rate max. average roll value, gallons per minute/square foot	D 4491	100-150
Permittivity 1/sec., min.	D 4491	0.05
Apparent opening size max. average roll value, U.S. Standard sieve size	D 4751	40
Ultraviolet Degradation percent of original unexposed grab breaking load 500 hr, minimum	D 4595	70

Sample under ASTM D 4354, Procedure C.

Test under ASTM D 4759. All properties are based on Minimum Average Roll Value (MARV).

Identify, store, and handle under ASTM D 4873.

## **Erosion Control Blanket**

Erosion control blanket must be:

1. Described as a rolled erosion control product (RECP)
2. Classified as temporary and degradable or long-term and non-degradable
3. Machine-made mats
4. Provided in rolled strips
5. Classified by the Erosion Control Technology Council (ECTC)

Erosion control blanket classified as temporary and degradable must be one of the following:

1. Double net excelsior blanket:
  - 1.1. Classified as ECTC Type 2D
  - 1.2. Classified as an erosion control blanket
  - 1.3. Designed to last for at least one year after installation
  - 1.4. With a Universal Soil Loss Equation (USLE) C-Factor of not more than 0.20 at a 2:1 (horizontal:vertical) slope
  - 1.5. With 80 percent of the wood excelsior fibers being 6 inches or longer
  - 1.6. Capable to withstand a maximum shear stress of 1.75 pounds per square foot under ASTM D 6460
  - 1.7. With a minimum tensile strength of 75 pounds per foot under ASTM D 5035
  - 1.8. With top and bottom surfaces covered with extruded photodegradable plastic netting or lightweight non-synthetic netting
2. Double net straw and coconut blanket:
  - 2.1. Classified as ECTC Type 2D
  - 2.2. Classified as an erosion control blanket
  - 2.3. Designed to last for at least one year after installation
  - 2.4. With a USLE C-Factor of not more than 0.20 at a 2:1 (horizontal:vertical) slope
  - 2.5. Comprised of 70 percent straw and 30 percent coconut fiber
  - 2.6. Capable to withstand a maximum shear stress of 1.75 pounds per square foot under ASTM D 6460
  - 2.7. With a minimum tensile strength of 75 pounds per foot under ASTM D 5035
  - 2.8. With top and bottom surfaces covered with extruded photodegradable plastic netting or lightweight non-synthetic netting
3. Jute netting:
  - 3.1. Classified as ECTC Type 3B
  - 3.2. Classified as an open weave textile and have from 14 to 20 strands per foot in each direction
  - 3.3. Designed to last for at least one year after installation
  - 3.4. With a USLE C-Factor of not more than 0.25 at a 1.5:1 (horizontal:vertical) slope
  - 3.5. Comprised of 100 percent unbleached and undyed spun yarn made of jute fiber
  - 3.6. With an average open area from 63 to 70 percent
  - 3.7. From 48 to 72 inches in width
  - 3.8. Capable to withstand a maximum shear stress of 2.0 pounds per square foot under ASTM D 6460
  - 3.9. With a minimum tensile strength of 100 pounds per foot under ASTM D 5035
  - 3.10. From 0.90 to 1.20 pounds per square yard in weight
4. Coir netting:
  - 4.1. Classified as ECTC Type 4
  - 4.2. Classified as an open weave textile and from 13 to 18 strands per foot in each direction
  - 4.3. Designed to last for at least three years after installation
  - 4.4. With a USLE C-Factor of not more than 0.25 at a 1:1 (horizontal:vertical) slope
  - 4.5. Comprised of 100 percent unbleached and undyed spun coir yarn made of coconut fiber

- 4.6. With an average open area from 63 to 70 percent
- 4.7. From 72 to 158 inches in width
- 4.8. Capable to withstand a maximum shear stress of 2.25 pounds per square foot under ASTM D6460
- 4.9. With a minimum tensile strength of 125 pounds per foot under ASTM D 5035
- 4.10. From 1.20 to 1.67 pounds per square yard in weight

Erosion control blanket classified as long-term and non-degradable must:

1. Be a geosynthetic fabric
2. Comply with the specifications for rock slope protection fabric (Class 8) in Section 88-1.06, "Channel and Shore Protection," of the Standard Specifications

**Staples**

You may use an alternative attachment device such as a geosynthetic pins or plastic pegs to install erosion control blanket.

**Rock**

Rock must comply with:

1. Requirements under Section 72-2.02, "Materials," of the Standard Specifications
2. Following sizes:

Square Screen Size (inch)	Percentage Passing	Percentage Retained
6	100	0
3	0	100

**Gravel-filled Bags**

Gravel-filled bags must:

1. Be made from fabric.
2. Have inside dimensions from 24 to 32 inches in length, and from 16 to 20 inches in width.
3. Have the opening bound to retain the gravel. The opening must be sewn with yarn, bound with wire, or secured with a closure device.
4. Weigh from 30 to 50 pounds when filled with gravel.

Gravel for gravel-filled bags must be:

1. From 3/8 to 3/4 inch in diameter
2. Clean and free from clay balls, organic matter, and other deleterious materials

**Linear Sediment Barrier**

Linear sediment barriers must consist of the following:

1. Gravel-filled bags

**CONSTRUCTION**

For drainage inlet protection at drainage inlets in paved and unpaved areas:

1. Prevent ponded runoff from encroaching on the traveled way or overtopping the curb or dike. Use linear sediment barriers to redirect runoff and control ponding.
2. Clear the area around each drainage inlet of obstructions including rocks, clods, and debris greater than one inch in diameter before installing the drainage inlet protection.
3. Install a linear sediment barrier up-slope of the existing drainage inlet and parallel with the curb, dike, or flow line to prevent sediment from entering the drainage inlet.

### **Erosion Control Blanket**

To install erosion control blanket and geosynthetic fabric:

1. Secure blanket or fabric to the surface of the excavated sediment trap with staples and embed in a trench adjacent to the drainage inlet
2. Anchor the perimeter edge of the erosion control blanket in a trench

### **Gravel Bag Berm**

If gravel bag berm is used as a linear sediment barrier:

1. Place gravel-filled bags end-to-end to eliminate gaps
2. Stack bags in a way that the bags in the top row overlap the joints in the lower row

If gravel bag berms are used for Type 3A and Type 3B:

1. Place gravel-filled bags end-to-end to eliminate gaps
2. Stack bags in a way that the bags in the top row overlap the joints in the lower row
3. Arrange bags to create a spillway by removing one or more gravel-filled bags from the upper layer

If used within shoulder area, place gravel-filled bags behind temporary railing (Type K).

### **MAINTENANCE**

Maintain temporary drainage inlet protection to provide sediment holding capacity and to reduce runoff velocities.

Remove sediment deposits, trash, and debris from temporary drainage inlet protection as needed or when directed by the Engineer. If removed sediment is deposited within project limits, it must be stabilized and not subject to erosion by wind or water. Trash and debris must be removed and disposed of as specified in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Maintain temporary drainage inlet protection by removing sediment from:

1. Behind flexible sediment barriers when sediment exceeds 1 inch in depth
2. Surface of the erosion control blanket when sediment exceeds 1 inch in depth
3. Sediment trap for Type 2 when the volume has been reduced by approximately one-half
4. Behind silt fence when the sediment is 1/3 the height of the silt fence fabric above ground
5. Sediment filter bags when filled or when the restraint cords are no longer visible

If rills and other evidence of concentrated runoff occur beneath the linear sediment barrier, repair or adjust the barrier.

Repair or replace sagging or slumping linear sediment barriers with additional stakes. Replace broken or split wood stakes.

Repair temporary drainage inlet protection within 24 hours of discovering damage unless the Engineer approves a longer period.

If your vehicles, equipment, or activities disturb or displace temporary drainage inlet protection, repair temporary drainage inlet protection at your expense.

The Department does not pay maintenance costs for cleanup, repair, removal, disposal, or replacement due to improper installation or your negligence.

### **REMOVAL**

When the Engineer determines that the temporary drainage inlet protection is not required, it must be removed and disposed of under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Ground disturbance, including holes and depressions, caused by the installation and removal of the temporary drainage inlet protection must be backfilled and repaired under Section 15-1.02, "Preservation of Property," of the Standard Specifications.

## **MEASUREMENT AND PAYMENT**

Quantities of temporary drainage inlet protection will be determined from actual count in place. The protection will be measured one time only and no additional measurement will be recognized.

The contract unit price paid for temporary drainage inlet protection includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the temporary drainage inlet protection, complete in place, including removal of materials, cleanup and disposal of retained sediment and debris, and backfilling and repairing holes, depressions and other ground disturbance, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

No additional compensation will be made if the temporary drainage inlet protection is relocated during the course of construction.

The State and you share the cost of maintaining the temporary drainage inlet protection. The State determines the maintenance cost under Section 9-1.03, "Force Account Payment," of the Standard Specifications and pays you one-half of that cost.

### **10-1.15 SCAFFOLDING**

Scaffolding shall be defined in accordance with and shall conform to the Construction Safety Orders of the Division of Occupational Safety and Health and these special provisions.

If scaffolding is constructed for this project over or adjacent to traffic, or suspended from the traveled way, the Contractor shall submit to the Engineer working drawings for scaffolding systems in conformance with Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, and these special provisions.

Scaffolding working drawings shall include the following:

- A. Descriptions, calculations, and values for all loads anticipated during the erection, use, and removal of scaffolding.
- B. Methods and equipment for erecting, moving, and removing scaffolding.
- C. Design details including bolt layouts, welding details, and any connections to existing structures.
- D. Stress sheets including a summary of computed stresses in the (1) scaffolding, (2) connections between scaffolding and any existing structures, and (3) existing load supporting members. The computed stresses shall include the effects of erection, movement, and removal of the scaffolding.

If manufactured scaffolding is used, the manufacturer's name, address, and phone number shall be shown on the working drawings.

The working drawings shall be stamped and signed by an engineer who is registered as a Civil Engineer. In addition, prior to submitting the working drawings to the Engineer, the working drawings shall be stamped and signed by an independent reviewer who is registered as a Civil Engineer in the State of California. The independent reviewer shall not be employed by the same entity preparing the working drawings.

The Contractor shall allow 7 days for the review of a complete submittal for scaffolding working drawings. In the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Welding for the manufacturing and erection of scaffolding shall conform to the requirements in AWS D1.1 or AWS D1.2 for steel or aluminum construction respectively.

Full compensation for conforming to the above requirements shall be considered as included in the contract prices paid for the various contract items of work, and no additional compensation will be allowed therefor.

### **10-1.16 COOPERATION**

It is anticipated that work by another contractor may be in progress adjacent to or within the limits of this project during progress of the work on this contract. The following table lists contracts anticipated to be in progress during this contract.

Contract No.	Co-Rte-PM	Location	Type of Work
07-259904	LA-710-25.9	Route 105 to Firestone Blvd.	Pavement rehabilitation and freeway widening
07-183124	LA-710-9.4/18.4	Route 105 to Firestone Blvd.	Landscaping
07-255904	LA-710-5.6/24.2	City of Long Beach to S. Humphreys Ave. overcrossing	Upgrade median barrier
07-269004	LA-710-18.1/20.8	0.3 miles south of Firestone Blvd. OC to 0.2 miles south of Slauson Ave.	Place hot mix asphalt
07-202124	LA-710-21.9/23.1	South Atlantic Blvd. to Triggs St.	Long life pavement and bridge widening

Comply with Section 7-1.14, "Cooperation," of the Standard Specifications.

### 10-1.17 PROGRESS SCHEDULE (CRITICAL PATH METHOD)

#### GENERAL

##### Summary

Comply with Section 8-1.04, "Progress Schedule," of the Standard Specifications, except you must:

1. Use a computer software to prepare the schedule
2. Furnish compatible software for the Engineer's exclusive possession and use

You are responsible for assuring that all activity sequences are logical and that each schedule shows a coordinated plan for complete performance of the work.

#### Definitions

**contract completion date:** The current extended date for completion of the contract shown on the weekly statement of working days furnished by the Engineer as specified in Section 8-1.06, "Time of Completion," of the Standard Specifications.

**data date:** The day after the date through which a schedule is current. Everything occurring earlier than the data date is "as-built" and everything on or after the data date is "planned."

**early completion time:** The difference in time between an early scheduled completion date and the contract completion date.

**float:** The difference between the earliest and latest allowable start or finish times for an activity.

**milestone:** An event activity that has zero duration and is typically used to represent the beginning or end of a certain stage of the project.

**narrative report:** A document submitted with each schedule that discusses topics related to project progress and scheduling.

**near critical path:** A chain of activities with total float exceeding that of the critical path but having no more than 10 working days of total float.

**State owned float activity:** The activity documenting time saved on the critical path by actions of the State. It is the last activity prior to the scheduled completion date.

**time impact analysis:** A schedule and narrative report developed specifically to demonstrate what effect a proposed change or delay has on the current scheduled completion date.

**time-scaled network diagram:** A graphic depiction of a CPM schedule comprised of activity bars with relationships for each activity represented by arrows. The tail of each arrow connects to the activity bar for the predecessor and points to the successor.

**total float:** The amount of time that an activity or chain of activities can be delayed before extending the scheduled completion date.

## **Submittals**

### **General Requirements**

Submit to the Engineer baseline, monthly updated, and final updated schedules, each consistent in all respects with the time and order of work requirements of the contract. Perform work in the sequence indicated on the current accepted schedule.

Each schedule must show:

1. Calculations using the critical path method to determine controlling activities.
2. Duration activities less than 20 working days.
3. At least 50 but not more than 500 activities, unless authorized. The number of activities must be sufficient to assure adequate planning of the project, to permit monitoring and evaluation of progress, and to do an analysis of time impacts.
4. Each required constraint. Constraints other than those required by the special provisions may be included only if authorized.
5. State-owned float as the predecessor activity to the scheduled completion date.
6. Activities with identification codes for responsibility, stage, work shifts, location, and contract pay item numbers.

You may show early completion time on any schedule provided that the requirements of the contract are met. Early completion time is considered a resource for your exclusive use. You may increase early completion time by improving production, reallocating resources to be more efficient, performing sequential activities concurrently, or by completing activities earlier than planned. You may also submit for approval a VECP as specified in Section 4-1.035B, "Value Engineering Change Proposal." of the Standard Specifications that will reduce time of construction.

You may show a scheduled completion date that is later than the contract completion date on an update schedule, after the baseline schedule is accepted. Provide an explanation for a late scheduled completion date in the narrative report that is included with the schedule.

State-owned float is considered a resource for the exclusive use of the State. The Engineer may accrue State-owned float by the early completion of review of any type of required submittal when it saves time on the critical path. Prepare a time impact analysis, when requested by the Engineer, to determine the effect of the action as specified in "Time Impact Analysis." The Engineer documents State-owned float by directing you to update the State-owned float activity on the next updated schedule. Include a log of the action on the State-owned float activity and include a discussion of the action in the narrative report. The Engineer may use State-owned float to mitigate past, present, or future State delays by offsetting potential time extensions for contract change orders.

The Engineer may adjust contract working days for ordered changes that affect the scheduled completion date as specified in Section 4-1.03, "Changes," of the Standard Specifications. Prepare a time impact analysis to determine the effect of the change as specified in "Time Impact Analysis" and include the impacts acceptable to the Engineer in the next updated schedule. Changes that do not affect the controlling operation on the critical path will not be considered as the basis for a time adjustment. Changes that do affect the controlling operation on the critical path will be considered by the Engineer in decreasing time or granting an extension of time for completion of the contract. Time extensions will only be granted if the total float is absorbed and the scheduled completion date is delayed one or more working days because of the ordered change.

The Engineer's review and acceptance of schedules does not waive any contract requirements and does not relieve you of any obligation or responsibility for submitting complete and accurate information. Correct rejected schedules and resubmit them within 7 days of notification by the Engineer, at which time a new review period of 7 days will begin.

Errors or omissions on schedules do not relieve you from finishing all work within the time limit specified for completion of the contract. If, after a schedule has been accepted by the Engineer, either you or the Engineer discover that any aspect of the schedule has an error or omission, you must correct it on the next updated schedule.

### **Computer Software**

Submit to the Engineer for review a description of proposed schedule software to be used. After the Engineer accepts the proposed software, furnish schedule software and all original software instruction manuals. All software must be compatible with the current version of the Windows operating system in use by the Engineer. The schedule software must include the latest version of Oracle Primavera P6 Professional Project Management for Windows, or equivalent.

If a schedule software equivalent to P6 is proposed, it must be capable of:

1. Generating files that can be imported into P6
2. Comparing 2 schedules and providing reports of changes in activity ID, activity description, constraints, calendar assignments, durations, and logic ties

The schedule software and schedule-comparing software will be returned to you before the final estimate. The Department will compensate you as specified in Section 4-1.03D, "Extra Work," of the Standard Specifications for replacement of software or manuals damaged, lost, or stolen after delivery to the Engineer.

Instruct the Engineer in the use of the software and provide software support until the contract is accepted. Within 15 days of contract approval, provide a commercial 8-hour training session for 2 Department employees in the use of the software at a location acceptable to the Engineer. It is recommended that you also send at least 2 employees to the same training session to facilitate development of similar knowledge and skills in the use of the software. If schedule software other than P6 is submitted, then the training session must be a total of 16-hours for each Department employee.

### **Network Diagrams, Reports, and Data**

Include the following with each schedule submittal:

1. Two sets of originally plotted, time-scaled network diagrams
2. Two copies of a narrative report
3. One read-only compact disk or floppy diskette containing the schedule data

The time-scaled network diagrams must conform to the following:

1. Show a continuous flow of information from left to right
2. Be based on early start and early finish dates of activities
3. Clearly show the primary paths of criticality using graphical presentation
4. Be prepared on 34" x 44"
5. Include a title block and a timeline on each page

The narrative report must be organized in the following sequence with all applicable documents included:

1. Transmittal letter
2. Work completed during the period
3. Identification of unusual conditions or restrictions regarding labor, equipment or material; including multiple shifts, 6-day work weeks, specified overtime or work at times other than regular days or hours
4. Description of the current critical path
5. Changes to the critical path and scheduled completion date since the last schedule submittal
6. Description of problem areas
7. Current and anticipated delays:
  - 7.1. Cause of delay
  - 7.2. Impact of delay on other activities, milestones, and completion dates
  - 7.3. Corrective action and schedule adjustments to correct the delay
8. Pending items and status thereof:
  - 8.1. Permits
  - 8.2. Change orders
  - 8.3. Time adjustments
  - 8.4. Noncompliance notices
9. Reasons for an early or late scheduled completion date in comparison to the contract completion date

Schedule submittals will only be considered complete when all documents and data have been submitted as described above.

### **Preconstruction Scheduling Conference**

Schedule a preconstruction scheduling conference with your project manager and the Engineer within 15 days after contract approval. The Engineer will conduct the meeting and review the requirements of this section with you.

Submit a general time-scaled logic diagram displaying the major activities and sequence of planned operations and be prepared to discuss the proposed work plan and schedule methodology that comply with the requirements of this section. If you propose deviations to the construction staging, then the general time-scaled logic diagram must also display the deviations and resulting time impacts. Be prepared to discuss the proposal.

At this meeting, also submit the alphanumeric coding structure and activity identification system for labeling work activities. To easily identify relationships, each activity description must indicate its associated scope or location of work by including such terms as quantity of material, type of work, bridge number, station to station location, side of highway (such as left, right, northbound, southbound), lane number, shoulder, ramp name, ramp line descriptor, or mainline.

The Engineer reviews the logic diagram, coding structure, and activity identification system, and provide any required baseline schedule changes to you for implementation.

### **Baseline Schedule**

Beginning the week following the preconstruction scheduling conference, meet with the Engineer weekly to discuss schedule development and resolve schedule issues until the baseline schedule is accepted.

Submit a baseline schedule within 20 days of contract approval. Allow 20 days for the Engineer's review after the baseline schedule and all support data are submitted. In addition, the baseline schedule submittal is not considered complete until the computer software is delivered and installed for use in review of the schedule.

The baseline schedule must include the entire scope of work and how you plan to complete all work contemplated. The baseline schedule must show the activities that define the critical path. Multiple critical paths and near-critical paths must be kept to a minimum. A total of not more than 50 percent of the baseline schedule activities must be critical or near critical, unless otherwise authorized.

The baseline schedule must not extend beyond the number of contract working days. The baseline schedule must have a data date of contract approval. If you start work before contract approval, the baseline schedule must have a data date of the 1st day you performed work at the job site.

If you submit an early completion baseline schedule that shows contract completion in less than 85 percent of the contract working days, the baseline schedule must be supplemented with resource allocations for every task activity and include time-scaled resource histograms. The resource allocations must be shown to a level of detail that facilitates report generation based on labor crafts and equipment classes for you and your subcontractors. Use average composite crews to display the labor loading of on-site construction activities. Optimize and level labor to reflect a reasonable plan for accomplishing the work of the contract and to assure that resources are not duplicated in concurrent activities. The time-scaled resource histograms must show labor crafts and equipment classes to be used. The Engineer may review the baseline schedule activity resource allocations using Means Productivity Standards or equivalent to determine if the schedule is practicable.

### **Updated Schedule**

Submit an updated schedule and meet with the Engineer to review contract progress, on or before the 1st day of each month, beginning one month after the baseline schedule is accepted. Allow 15 days for the Engineer's review after the updated schedule and all support data are submitted, except that the review period will not start until the previous month's required schedule is accepted. Updated schedules that are not accepted or rejected within the review period are considered accepted by the Engineer.

The updated schedule must have a data date of the 21st day of the month or other date established by the Engineer. The updated schedule must show the status of work actually completed to date and the work yet to be performed as planned. Actual activity start dates, percent complete, and finish dates must be shown as applicable. Durations for work that has been completed must be shown on the updated schedule as the work actually occurred, including Engineer submittal review and your resubmittal times.

You may include modifications such as adding or deleting activities or changing activity constraints, durations, or logic that do not (1) alter the critical path(s) or near critical path(s) or (2) extend the scheduled completion date compared to that shown on the current accepted schedule. Justify in writing the reasons for any changes to planned work. If any proposed changes in planned work will result in (1) or (2) above, then submit a time impact analysis as specified in this section.

### **Time Impact Analysis**

Submit a written time impact analysis (TIA) with each request for adjustment of contract time, or when you or the Engineer consider that an approved or anticipated change may impact the critical path or contract progress.

The TIA must illustrate the impacts of each change or delay on the current scheduled completion date or internal milestone, as appropriate. The analysis must use the accepted schedule that has a data date closest to and before the event. If the Engineer determines that the accepted schedule used does not appropriately represent the conditions before the event, the accepted schedule must be updated to the day before the event being analyzed. The TIA must include an impact schedule developed from incorporating the event into the accepted schedule by adding or deleting activities, or by changing durations or logic of existing activities. If the impact schedule shows that incorporating the event modifies the critical path and scheduled completion date of the accepted schedule, the difference between scheduled completion dates of the two schedules must be equal to the adjustment of contract time. The Engineer may construct and use an appropriate project schedule or other recognized method to determine adjustments in contract time until you provide the TIA.

Submit 2 copies of your TIA within 20 days of receiving a written request for a TIA from the Engineer. Allow the Engineer 15 days after receipt to review the submitted TIA. All approved TIA schedule changes must be shown on the next updated schedule.

If a TIA you submit is rejected, meet with the Engineer to discuss and resolve issues related to the TIA. If clarification is still needed, you are allowed 15 days to submit a protest as specified in Section 5-1.011, "Protests," of the Standard Specifications. If agreement is not reached, you are allowed 5 days from the date you receive the Engineer's response to your protest to submit an Initial Potential Claim Record as specified in Section 5-1.146B, "Initial Potential Claim Record," of the Standard Specifications. Only show actual as-built work, not unapproved changes related to the TIA, in subsequent updated schedules. If agreement is reached at a later date, approved TIA schedule changes must be shown on the next updated schedule. The Engineer withholds remaining payment on the schedule contract item if a TIA is requested and not submitted within 20 days. The schedule item payment resumes on the next estimate after the requested TIA is submitted. No other contract payment is withheld regarding TIA submittals.

### **Final Updated Schedule**

Submit a final update, as-built schedule with actual start and finish dates for the activities, within 30 days after completion of contract work. Provide a written certificate with this submittal signed by your project manager or an officer of the company stating, "To my knowledge and belief, the enclosed final update schedule reflects the actual start and finish dates of the actual activities for the project contained herein." An officer of the company may delegate in writing the authority to sign the certificate to a responsible manager.

### **PAYMENT**

Progress schedule (critical path method) will be paid for at a lump sum price. The contract lump sum price paid for progress schedule (critical path method) includes full compensation for furnishing all labor, material, tools, equipment, and incidentals, including computer software, and for doing all the work involved in preparing, furnishing, and updating schedules, and instructing and assisting the Engineer in the use of computer software, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Payments for the progress schedule (critical path method) contract item will be made progressively as follows:

1. A total of 25 percent of the item amount will be paid upon achieving all of the following:
  - 1.1. Completion of 5 percent of all contract item work.
  - 1.2. Acceptance of all schedules and approval of all TIAs required to the time when 5 percent of all contract item work is complete.
  - 1.3. Delivery of schedule software to the Engineer.
  - 1.4. Completion of required schedule software training.
2. A total of 50 percent of the item amount will be paid upon completion of 25 percent of all contract item work and acceptance of all schedules and approval of all TIAs required to the time when 25 percent of all contract item work is complete.
3. A total of 75 percent of the item amount will be paid upon completion of 50 percent of all contract item work and acceptance of all schedules and approval of all TIAs required to the time when 50 percent of all contract item work is complete.
4. A total of 100 percent of the item amount will be paid upon completion of all contract item work, acceptance of all schedules and approval of all TIAs required to the time when all contract item work is complete, and submittal of the certified final update schedule.

If you fail to complete any of the work or provide any of the schedules required by this section, the Engineer makes an adjustment in compensation as specified in Section 4-1.03C, "Changes in Character of Work," of the Standard Specifications for the work not performed. Adjustments in compensation for schedules will not be made for any increased or decreased work ordered by the Engineer in submitting schedules.

### **10-1.18 TIME-RELATED OVERHEAD**

The Contractor will be compensated for time-related overhead as described below and in conformance with "Force Account Payment" of these special provisions. The Contractor will not be compensated for time-related overhead for delays to the controlling operations caused by the Engineer that occur prior to the first working day, but will be compensated for actual overhead costs incurred, as determined by an independent Certified Public Accountant audit examination and report.

Attention is directed to "Beginning of Work, Time of Completion and Liquidated Damages," "Force Account Payment," and "Progress Schedule (Critical Path Method)" of these special provisions.

The provisions in Section 9-1.08D(2)(b), "Overhead Claims," of the Standard Specifications shall not apply.

Time-related overhead shall consist of those overhead costs, including field and home office overhead, that are in proportion to the time required to complete the work. Time-related overhead shall not include costs that are not related to time, including but not limited to, mobilization, licenses, permits, and other charges incurred only once during the contract. Time-related overhead shall not apply to subcontractors of any tier, suppliers, fabricators, manufacturers, or other parties associated with the Contractor.

Field office overhead expenses include time-related costs associated with the normal and recurring operations of the construction project, and shall not include costs directly attributable to the work of the contract. Time-related costs of field office overhead include, but are not limited to, salaries, benefits, and equipment costs of project managers, general superintendents, field office managers and other field office staff assigned to the project, and rent, utilities, maintenance, security, supplies, and equipment costs of the project field office.

Home office overhead or general and administrative expenses refer to the fixed costs of operating the Contractor's business. These costs include, but are not limited to, general administration, insurance, personnel and subcontract administration, purchasing, accounting, and project engineering and estimating. Home office overhead costs shall exclude expenses specifically related to other contracts or other businesses of the Contractor, equipment coordination, material deliveries, and consultant and legal fees.

The quantity of time-related overhead associated with a reduction in contract time for an accepted VECP under Section 4-1.035B, "Value Engineering Change Proposal," of the Standard Specifications shall be considered a construction cost attributable to the resultant estimated net savings due to the cost reduction incentive.

If the final increased quantity of time-related overhead exceeds 149 percent of the number of working days specified in the verified Bid Item List, the Contractor shall, within 60 days of the Engineer's written request, submit to the Engineer an audit examination and report performed by an independent Certified Public Accountant of the Contractor's actual overhead costs. The audit examination and report shall depict the Contractor's project and company-wide financial records and shall specify the actual overall average daily rates for both field and home office overhead for the entire duration of the project, and whether the costs have been properly allocated. The rates of field and home office overhead shall exclude unallowable costs as determined in the Federal Acquisition Regulations, 48 CFR, Chapter 1, Part 31.

Independent Certified Public Accountant's audit examinations shall be performed in conformance with the requirements of the American Institute of Certified Public Accountants Attestation Standards. Audit examinations and reports shall determine if the rates of field office overhead and home office overhead are:

- A. Allowable in conformance with the requirements of the Federal Acquisition Regulations, 48 CFR, Chapter 1, Part 31.
- B. Adequately supported by reliable documentation.
- C. Related solely to the project under examination.

Within 20 days of receipt of the Engineer's written request, the Contractor shall make its financial records available for audit by the State for the purpose of verifying the actual rate of time-related overhead specified in the audit submitted by the Contractor. The actual rate of time-related overhead specified in the audit, submitted by the Contractor, will be subject to approval by the Engineer.

If the Engineer requests the independent Certified Public Accountant audit, or if it is requested in writing by the Contractor, the contract item payment rate for time-related overhead, in excess of 149 percent of the number of working days specified in the verified Bid Item List, will be adjusted to reflect the actual rate.

The cost of performing an independent Certified Public Accountant audit examination and submitting the report, requested by the Engineer, will be borne equally by the State and the Contractor. The division of the cost will be made by determining the cost of providing an audit examination and report in conformance with the provisions of Section 9-1.04, "Extra Work Performed by Specialists," of the Standard Specifications, and paying to the Contractor one-half of that cost. The cost of performing an audit examination and submitting the independent Certified Public Accountant audit report for overhead claims other than for the purpose of verifying the actual rate of time-related overhead shall be entirely borne by the Contractor. The cost of performing an audit examination and submitting the independent Certified Public Accountant audit report to verify actual overhead costs incurred prior to the first working day shall be entirely borne by the Contractor.

The quantity of time-related overhead to be paid will be measured by the working day, designated in the verified Bid Item List as WDAY. The estimated number of working days is the number of working days, excluding days for plant establishment, as specified in "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions. The quantity of time-related overhead will be increased or decreased only as a result of suspensions or adjustments of contract time which revise the current contract completion date, and which satisfy any of the following criteria:

- A. Suspensions of work ordered in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications, except:
  1. Suspensions ordered due to weather conditions being unfavorable for the suitable prosecution of the controlling operation or operations.
  2. Suspensions ordered due to the failure on the part of the Contractor to carry out orders given, or to perform the provisions of the contract.
  3. Suspensions ordered due to factors beyond the control of and not caused by the State or the Contractor, for which the Contractor is granted non-working days.
  4. Other suspensions that mutually benefit the State and the Contractor.
- B. Adjustments of contract time granted by the State set forth in approved contract change orders, in conformance with the provisions in Section 4-1.03, "Changes," of the Standard Specifications.

A delay to the controlling operation may be concurrent and any of the following:

1. Nonexcusable: A nonexcusable delay is caused by the fault, nonperformance, or deficiency of the Contractor, subcontractors of any tier, or suppliers. The days during a nonexcusable delay are working days. No time or payment adjustment for a nonexcusable delay is allowed.
2. Excusable: An excusable delay is caused by factors beyond the control and without the fault of the State or the Contractor. The days during an excusable delay are non-working days.
3. Compensable: A compensable delay is caused solely by the fault, deficiency, error, omission, or change made by the State. A time adjustment and a payment adjustment for the actual cost without markup or profit are allowed.

A concurrent delay occurs when 2 or more separate delays overlap partially or entirely. A nonexcusable delay concurrent with either an excusable or a compensable delay is a nonexcusable delay. An excusable delay concurrent with a compensable delay is an excusable delay.

The quantity of time-related overhead is only adjusted as a result of a compensable delay and is not adjusted as a result of either a nonexcusable or an excusable delay.

An approved time impact analysis submitted as specified in "Progress Schedule (Critical Path Method)" of these special provisions is used to determine the type and duration of a delay.

In the event an early completion progress schedule, as defined in "Progress Schedule (Critical Path Method)" of these special provisions, is submitted by the Contractor and approved by the Engineer, the amount of time-related overhead eligible for payment will be based on the total number of working days for the project, in conformance with the provisions in "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions, rather than the Contractor's early completion progress schedule.

The contract price paid per working day for time-related overhead shall include full compensation for time-related overhead, including the Contractor's share of costs of the independent Certified Public Accountant audit of overhead costs requested by the Engineer, as specified in these special provisions, and as directed by the Engineer.

The provisions in Sections 4-1.03B, "Increased or Decreased Quantities," and 4-1.03C, "Changes in Character of the Work," of the Standard Specifications shall not apply to the contract item of time-related overhead.

Full compensation for additional overhead costs incurred during days of inclement weather when the contract work is extended into additional construction seasons due to delays caused by the State shall be considered as included in the time-related overhead paid during the contract working days, and no additional compensation will be allowed therefor.

Full compensation for additional overhead costs involved in performing additional contract item work that is not a controlling operation shall be considered as included in the contract items of work involved and no additional compensation will be allowed therefor.

Full compensation for overhead, other than time-related overhead measured and paid for as specified above, and other than overhead costs included in the markups specified in "Force Account Payment" of these special provisions, shall be considered as included in the various items of work and no additional compensation will be allowed therefor.

Overhead costs incurred by subcontractors of any tier, suppliers, fabricators, manufacturers, and other parties associated with the Contractor shall be considered as included in the various items of work and as specified in Section 9-1.03, "Force Account Payment," of the Standard Specifications.

For the purpose of making progress payments pursuant to the provisions in Section 9-1.07, "Progress Payments," of the Standard Specifications, the number of working days to be paid for time-related overhead in each monthly partial payment will be the number of working days, specified above to be measured for payment that occurred during that monthly estimate period, including compensable suspensions and right of way delays. Working days granted by contract change order due to extra work or changes in character of the work, will be paid for upon completion of the contract. The amount earned per working day for time-related overhead shall be the lesser of the following amounts:

- A. The contract item price.
- B. Twenty percent of the original total contract amount divided by the number of working days specified in "Beginning of Work, Time of Completion and Liquidated Damages," of these special provisions.

After the work has been completed, except plant establishment work, as provided in Section 20-4.08, "Plant Establishment Work," of the Standard Specifications, the amount of the total contract item price for time-related overhead not yet paid will be included for payment in the first estimate made after completion of roadway construction work, in conformance with the provisions in Section 9-1.07, "Progress Payments," of the Standard Specifications.

#### **10-1.19 CONSTRUCTION AREA TRAFFIC CONTROL DEVICES**

Flagging, signs, and temporary traffic control devices furnished, installed, maintained, and removed when no longer required shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Category 1 temporary traffic control devices are defined as small and lightweight (less than 100 pounds) devices. These devices shall be certified as crashworthy by crash testing, crash testing of similar devices, or years of demonstrable safe performance. Category 1 temporary traffic control devices include traffic cones, plastic drums, portable delineators, and channelizers.

If requested by the Engineer, the Contractor shall provide written self-certification for crashworthiness of Category 1 temporary traffic control devices at least 5 business days before beginning any work using the devices or within 2 business days after the request if the devices are already in use. Self-certification shall be provided by the manufacturer or Contractor and shall include the following:

- A. Date,
- B. Federal Aid number (if applicable),
- C. Contract number, district, county, route and post mile of project limits,
- D. Company name of certifying vendor, street address, city, state and zip code,
- E. Printed name, signature and title of certifying person; and
- F. Category 1 temporary traffic control devices that will be used on the project.

The Contractor may obtain a standard form for self-certification from the Engineer.

Category 2 temporary traffic control devices are defined as small and lightweight (less than 100 pounds) devices that are not expected to produce significant vehicular velocity change, but may cause potential harm to impacting vehicles. Category 2 temporary traffic control devices include barricades and portable sign supports.

Category 2 temporary traffic control devices shall be on the Federal Highway Administration's (FHWA) list of Acceptable Crashworthy Category 2 Hardware for Work Zones. This list is maintained by FHWA and can be located at:

[http://safety.fhwa.dot.gov/roadway\\_dept/policy\\_guide/road\\_hardware/listing.cfm?code=workzone](http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/listing.cfm?code=workzone)

The Department also maintains this list at:

<http://www.dot.ca.gov/hq/traffops/signtech/signdel/pdf/Category2.pdf>

Category 2 temporary traffic control devices that have not received FHWA acceptance shall not be used. Category 2 temporary traffic control devices in use that have received FHWA acceptance shall be labeled with the FHWA acceptance letter number and the name of the manufacturer. The label shall be readable and permanently affixed by the manufacturer. Category 2 temporary traffic control devices without a label shall not be used.

If requested by the Engineer, the Contractor shall provide a written list of Category 2 temporary traffic control devices to be used on the project at least 5 business days before beginning any work using the devices or within 2 business days after the request if the devices are already in use.

Category 3 temporary traffic control devices consist of temporary traffic-handling equipment and devices that weigh 100 pounds or more and are expected to produce significant vehicular velocity change to impacting vehicles. Temporary traffic-handling equipment and devices include crash cushions, truck-mounted attenuators, temporary railing, temporary barrier, and end treatments for temporary railing and barrier.

Type III barricades may be used as sign supports if the barricades have been successfully crash tested, meeting the NCHRP Report 350 criteria, as one unit with a construction area sign attached.

Category 3 temporary traffic control devices shall be shown on the plans or on the Department's Highway Safety Features list. This list is maintained by the Division of Engineering Services and can be found at:

[http://www.dot.ca.gov/hq/esc/approved\\_products\\_list/](http://www.dot.ca.gov/hq/esc/approved_products_list/)

Category 3 temporary traffic control devices that are not shown on the plans or not listed on the Department's Highway Safety Features list shall not be used.

Full compensation for providing self-certification for crashworthiness of Category 1 temporary traffic control devices and for providing a list of Category 2 temporary traffic control devices used on the project shall be considered as included in the prices paid for the various items of work requiring the use of the Category 1 or Category 2 temporary traffic control devices and no additional compensation will be allowed therefor.

**10-1.20 CONSTRUCTION AREA SIGNS**

Construction area signs for temporary traffic control shall be furnished, installed, maintained, and removed when no longer required in conformance with the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Attention is directed to "Furnish Sign" of these special provisions.

Attention is directed to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. Type II retroreflective sheeting shall not be used on construction area sign panels. Type III, IV, VII, VIII, or IX retroreflective sheeting shall be used for stationary mounted construction area sign panels.

Attention is directed to "Construction Project Information Signs" of these special provisions regarding the number and type of construction project information signs to be furnished, erected, maintained, and removed and disposed of.

Unless otherwise shown on the plans or specified in these special provisions, the color of construction area warning and guide signs shall have black legend and border on orange background, except W10-1 or W47(CA) (Highway-Rail Grade Crossing Advance Warning) sign shall have black legend and border on yellow background.

Orange background on construction area signs shall be fluorescent orange.

Repair to construction area sign panels will not be allowed, except when approved by the Engineer. At nighttime under vehicular headlight illumination, sign panels that exhibit irregular luminance, shadowing or dark blotches shall be immediately replaced at the Contractor's expense.

The Contractor shall notify the appropriate regional notification center for operators of subsurface installations at least 2 business days, but not more than 14 days, prior to commencing excavation for construction area sign posts. The regional notification centers include, but are not limited to, the following:

Notification Center	Telephone Number
Underground Service Alert	811

Excavations required to install construction area signs shall be performed by hand methods without the use of power equipment, except that power equipment may be used if it is determined there are no utility facilities in the area of the proposed post holes. The post hole diameter, if backfilled with portland cement concrete, shall be at least 4 inches greater than the longer dimension of the post cross section.

Construction area signs placed within 15 feet from the edge of the travel way shall be mounted on stationary mounted sign supports as specified in "Construction Area Traffic Control Devices" of these special provisions.

The Contractor shall maintain accurate information on construction area signs. Signs that are no longer required shall be immediately covered or removed. Signs that convey inaccurate information shall be immediately replaced or the information shall be corrected. Covers shall be replaced when they no longer cover the signs properly. The Contractor shall immediately restore to the original position and location any sign that is displaced or overturned, from any cause, during the progress of work.

The term "construction area signs" shall include temporary object markers required for the direction of public traffic through or around the work during construction. Object markers listed or designated on the plans as construction area signs shall be considered to be signs and shall be furnished, erected, maintained, and removed by the Contractor in the same manner specified for construction area signs.

Object markers shall be stationary mounted on wood or metal posts in conformance with the details shown on the plans and the provisions in Section 82, "Markers and Delineators," of the Standard Specifications.

Marker panels for Type P (CA) object marker shall conform to the provisions for sign panels for stationary mounted signs.

Full compensation for furnishing, installing, maintaining and removing temporary roadside signs and marker panels shown on the motorist information, stage construction and traffic handling plans shall be considered as included in the contract lump sum price paid for construction area signs and no separate payment will be made therefor.

**10-1.21 MAINTAINING TRAFFIC**

Maintaining traffic shall conform to the provisions in Sections 7-1.08, "Public Convenience," Section 7-1.09, "Public Safety," and Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Closure is defined as the closure of a traffic lane or lanes, including shoulder, ramp or connector lanes, within a single traffic control system.

Closures shall conform to the provisions in "Traffic Control System for Lane Closure" of these special provisions.

In addition to the provisions set forth in Section 7-1.09, "Public Safety," of the Standard Specifications, whenever work, including the work of installing, maintaining, and removing temporary railing (Type K) is to be performed on the freeway within 6 feet of the adjacent traffic lane, the adjacent traffic lane shall be closed.

Except as listed above, closure of adjacent traffic lane will not be required for grinding operations, for sawcutting concrete slabs or installing loop detectors with an Impact Attenuator Vehicle (IAV) as a shadow vehicle, and for installing, maintaining and removing traffic control devices.

At locations where falsework pavement lighting or pedestrian openings through falsework are designated, falsework lighting shall be installed in conformance with the provisions in Section 86-6.11, "Falsework Lighting," of the Standard Specifications.

Openings shall be provided through bridge falsework for the use of public traffic at each location where falsework is constructed over the streets or routes listed in the following table. The type, minimum width, height, and number of openings at each location, and the location and maximum spacing of falsework lighting, if required for each opening, shall conform to the requirements in the table. The width of vehicular openings shall be the clear width between temporary railings or other protective work. The spacing shown for falsework pavement lighting is the maximum distance center to center in feet between fixtures.

Atlantic Boulevard On-Ramp Undercrossing  
(Bridge Number 53-3067)

	Number	Width	Height
Vehicle Openings	2	36	15'-6"
Pedestrian Openings	1	8'	15'
	Location	Spacing	
Falsework Pavement Lighting	R and L	22.5	

(Width and Height in feet)  
(R = Right side of traffic. L = Left side of traffic)  
(C = Centered overhead)

Route 5 Southbound  
Route 710/5 Separation (East) (Bridge Number 53-0785R)  
Route 710/5 Separation (West) (Bridge Number 53-0788L)

	Number	Width	Height
Vehicle Openings	1	49	15'-6"
	Location	Spacing	
Falsework Pavement Lighting	R and L	30	

(Width and Height in feet)  
(R = Right side of traffic. L = Left side of traffic)  
(C = Centered overhead)

Route 5 Northbound  
Route 710/5 Separation (East) (Bridge Number 53-0785R)  
Route 710/5 Separation (West) (Bridge Number 53-0788L)

	Number	Width	Height
Vehicle Openings	1	61	15'-6"
	Location	Spacing	
Falsework Pavement Lighting	R and L C	40 40 staggered 1/2 space	

(Width and Height in feet)  
(R = Right side of traffic. L = Left side of traffic)  
(C = Centered overhead)

Telegraph Road  
Route 710/5 Separation (East) (Bridge Number 53-0785R)  
Route 710/5 Separation (West) (Bridge Number 53-0788L)

	Number	Width	Height
Vehicle Openings	2	32	15'-6"
Pedestrian Openings	1	8	15
	Location	Spacing	
Falsework Pavement Lighting	R and L	30 staggered 1/2 space	

(Width and Height in feet)  
(R = Right side of traffic. L = Left side of traffic)  
(C = Centered overhead)

SB 710 to SB I-5 Connector/NB I-5 to NB 710 Connector  
Route 710/5 Separation (East) (Bridge Number 53-0785R)

	Number	Width	Height
Vehicle Openings	1	61	15'-6"
	Location	Spacing	
Falsework Pavement Lighting	R and L C	40 40 staggered 1/2 space	

(Width and Height in feet)  
(R = Right side of traffic. L = Left side of traffic)  
(C = Centered overhead)

NB 710 to NB I-5 Connector  
Route 710/5 Separation (West) (Bridge Number 53-0788L)

	Number	Width	Height
Vehicle Openings	1	37	15'-6"
	Location	Spacing	
Falsework Pavement Lighting	R and L	40 staggered 1/2 space	

(Width and Height in feet)  
(R = Right side of traffic. L = Left side of traffic)  
(C = Centered overhead)

The exact location of openings will be determined by the Engineer.

Work that interferes with public traffic shall be limited to the hours when closures are allowed, except for work required under Sections 7-1.08, "Public Convenience," and Section 7-1.09, "Public Safety."

The full width of the ramp traveled way shall be open for use by public traffic on designated legal holidays.

Designated legal holidays are: January 1st, the third Monday in February, the last Monday in May, July 4th, the first Monday in September, November 11th, Thanksgiving Day, and December 25th. When a designated legal holiday falls on a Sunday, the following Monday shall be a designated legal holiday. When November 11th falls on a Saturday, the preceding Friday shall be a designated legal holiday.

Special days are: Martin Luther King Jr Day and Columbus Day.

Not more than one separate stationary lane closure will be allowed in each direction of travel at one time.

At the Contractor's option, work may be performed during the hours designated as "No work permitted" shown on Charts 1 through 8, provided temporary traffic screen is installed on top of temporary railing (Type K), as shown on the plans. No traffic screens will be permitted on the right side of traffic within the limits of a right horizontal curve with a radius less than 2000 feet as viewed in the direction of travel and on the left side of traffic within the limits of a left horizontal curve with a radius less than 2000 feet as viewed in the direction of travel. Temporary traffic screen shall be furnished, installed, maintained, and removed at the Contractor's expense.

In addition to the requirements in "Impact Attenuator Vehicle" of these special provisions, when performing traffic control for stationary lane closures where median shoulders are less than 8 feet, the Contractor shall conform to the requirements as shown on the Traffic Handling Details Plan titled "Traffic Control System For Median Shoulders Less Than 8 Feet."

Prior to using shoulders as traffic lanes for the duration of workshift closures as shown on the Traffic Handling Plans - Stage 5, Phases 3 and 5, or as specified on Tables 6 and 7, pull boxes shall be filled with sand and paved over with 1 inch of commercial quality hot mix asphalt extending 6 inches beyond the edges of the pull boxes. Shoulders shall be swept and cleared of debris prior to traffic use. Upon completion of work requiring use of shoulders as traffic lanes, pull boxes shall be restored to their original condition. Full compensation for converting shoulders to traffic lanes as shown on the plans, including modifying and restoring pull boxes shall be considered as included in the contract lump sum price paid for traffic control system and no additional compensation will be allowed.

When removing and replacing concrete pavement slabs with precast panel concrete pavement slabs as shown on the Traffic Handling Plans - Stage 5, Location 2, the Contractor shall schedule operations in conformance with the hours and requirements as shown on Charts 9 through 13 in place of Charts 3 through 8. The Contractor shall not work at more than one location at one time nor on Stage 5, Locations 1 and 2, at the same time.

Except as otherwise provided in the special provisions, or designated portion of work to be completed within the extended weekend closure operation, when removing and replacing concrete pavement and approach slabs, the Contractor shall schedule operations in conformance with the hours and requirements as shown on Tables 1 through 10 in place of Charts 3 through 8. The Contractor shall place a C43(CA) sign every 500 feet throughout the length of the closure during the entire curing period. The Contractor shall not work at more than one location in each direction of travel at one time.

In lieu of the conflicting portions of Lane Closure Charts 3 and 8, the Contractor shall provide the number of through traffic lanes on Route 710 as shown on the Traffic Handling Plans - Stage 5, Phases 3 and 5, when operating the detour for extended periods of time. Extended periods of time shall begin at 0600 hours Saturday and end at 2300 hours the following Sunday for NB and SB Route 710. The Contractor shall furnish and place portable changeable message signs and post detour signs at locations designated on the Motorist Information Plans or as specified in these special provisions. The hours of operation and messages to be displayed on the portable changeable message signs shall be as specified on the plans or as directed by the Engineer. Route 710 may be closed to public traffic to set up and remove detours as shown on Stage 5, Phases 3 and 5, in conformance with the hours and requirements as shown on Table 11.

When a designated legal holiday falls between and including Thursday and the following Tuesday, no extended weekend closure will be allowed as stated above.

In lieu of the conflicting portions of Lane Closure Charts 1 and 14, the Contractor may provide at least two adjacent through traffic freeway lanes for a duration of 4 hours (2200 Saturday to 0200 Sunday) followed by 6 hours (0200 - 0800 Sunday) of complete freeway closure on NB Route 5 for construction of Bent 4 on Bridge No. 53-0785R and Bent 7 on Bridge No. 53-0788L for one time on each bent. The Contractor shall furnish and place portable changeable message signs and post detour signs at locations designated on the Motorist Information Plans or as specified in these special provisions. The hours of operation and messages to be displayed on the portable changeable message signs shall be as specified on the plans or as directed by the Engineer.

Route 5 may be closed to public traffic in each direction of travel at one time for falsework erection and removal, and bent construction in conformance with the hours and requirements as shown on Charts 14 and 15.

Route 710 may be closed to public traffic at one location in each direction of travel at one time for 2 post overhead sign structure installation and removal, loop detector installation, bent construction, approach slab replacement, and striping in conformance with the hours and requirements as shown on Charts 16 through 35. When installing loop detectors on SB Route 710, between Ramona Blvd UC and Floral Dr/Cesar Chavez Ave off-ramp, the Contractor shall close freeway lanes as shown on the Traffic Handling Details Plan titled "Traffic Control System For "Flip-Flop" Operation."

Except as otherwise provided in these special provisions, the Contractor will be permitted to close the NB Route 5 to NB Route 710 connector for construction of Bent 3 on Bridge No. 53-0785R for one extended period of time beginning at 2000 Saturday through 0600 the following Monday in place of Chart 36. A portable changeable message sign shall be placed at a location on the connector, as determined by the Engineer, 7 continuous days in advance of the date of the planned closure, with the weekend message: "RAMP / WILL BE / CLOSED – NEXT / WEEKEND", and with a weekday message: "RAMP / WILL BE / CLOSED – THIS / WEEKEND."

Except as otherwise provided in these special provisions, the Contractor will be permitted to close the NB Route 710 to NB Route 5 connector for one weekend for construction of Bent 6 on Bridge No. 53-0788L for an extended period of time beginning at 2300 Friday through 0500 Monday in place of Chart 38. A portable changeable message sign shall be placed at a location on the connector, as determined by the Engineer, 7 continuous days in advance of the date of the planned closure, with the weekend message: "RAMP / WILL BE / CLOSED – NEXT / WEEKEND," and with a weekday message: "RAMP / WILL BE /CLOSED - THIS / WEEKEND." When the connector is closed, the Contractor shall detour traffic and place a portable changeable message sign as indicated on Chart 38. The Contractor will be permitted to close one lane on the NB Route 710 to NB Route 5 connector as shown on the plans during curing time of Bent 6 for an extended period of time beginning at 0500 Monday through 0500 the following Wednesday.

Except as otherwise specified on Charts 49 through 82 in these special provisions, other ramps may be closed when the adjacent freeway lane is permitted to be closed as shown on Charts 1 through 48. When an on-ramp is closed and a ramp closure chart has not been included in this section "Maintaining Traffic", public traffic shall be detoured to the next available on-ramp downstream of the closed ramp in the direction of travel. A minimum of 15 special freeway detour signs (SP-2), as shown on the plans, shall be posted along the detour route and shall be removed at the end of each closure.

Except as otherwise specified in these special provisions, closure of on-ramps or off-ramps servicing 2 consecutive local street interchanges in the same direction of travel will not be allowed. Deviations from ramp closure requirements shall be requested in writing by the Contractor and submitted to the Engineer for approval. The Engineer may permit the deviations if public traffic will be better served and the work expedited. If 2 or more consecutive on-ramps are permitted or as specified in these special provisions to be closed, special signs for entrance ramp closures (SP-4) as shown on the plans shall be furnished and installed at the Contractor's expense. When an off-ramp is closed, the Contractor shall furnish and erect special signs for exit ramp closures (SP-3 or SP-5), as shown on the plans. This sign shall be placed on the right shoulder of freeway upstream of the preceding off-ramp.

Special advance notice publicity signs (SP-1), as shown on the plans, shall be posted at locations as determined by the Engineer, a minimum of 7 days prior to ramp or connector closures. Accurate information shall be maintained on the SP-1 signs. When work is not actively in progress, SP-1 signs shall be removed or covered.

Full compensation for furnishing, erecting, maintaining, and removing special advance notice publicity signs (SP-1), special portable freeway detour signs (SP-2, SP-6 and SP-7), special signs for exit ramp closures (SP-3 or SP-5) and C43(CA) signs as shown on the plans shall be considered as included in the contract lump sum price paid for traffic control system and no separate payment will be made therefor.

Special signs shall be disposed of as provided in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way" of the Standard Specifications at the conclusion of the project.

Work that encroaches onto the Route 710 freeway traveled ways, between Imperial Highway and Route 5, and the following ramps:

- A. EB Firestone Blvd On-ramps to Route 710
- B. Firestone Blvd Off-ramps from Route 710

will not be allowed from 3 hours before to 2 hours following the South Gate Holiday Christmas Parade, unless otherwise permitted by the Engineer.

City streets may be closed during the hours shown on Charts 83 through 87 included in this section "Maintaining Traffic" for the purpose of falsework installation and removal, or girder erection. When a street is completely closed, traffic shall be detoured as shown on the Motorist Information Plans. Only one complete city street closure at a time shall be permitted. The Contractor shall furnish and place portable changeable message signs and post detour signs at locations designated on the Motorist Information Plans. The hours of operation and messages to be displayed on the portable changeable message signs shall be as specified on the plans or as directed by the Engineer.

Local authorities shall be notified at least 5 business days before work begins. The Contractor shall cooperate with local authorities to handle traffic through the work area and shall make arrangements to keep the work area clear of parked vehicles.

Personal vehicles of the Contractor's employees shall not be parked within the right of way.

When work vehicles or equipment are parked within 6 feet of a traffic lane to perform active construction, the shoulder area shall be closed as shown on the plans.

If minor deviations from the requirements of this section concerning hours of work are required, a written request shall be submitted to the Engineer at least 15 days before the proposed date of the closure. The Engineer may approve the deviations if there is no significant increase in the cost to the State and if the work can be expedited and better serve the public traffic.

Pedestrian access facilities shall be provided through construction areas within the right of way as shown on the plans and as specified herein. Pedestrian walkways shall be surfaced with hot mix asphalt, portland cement concrete or timber. The surface shall be skid resistant and free of irregularities. Hand railings shall be provided on each side of pedestrian walkways as necessary to protect pedestrian traffic from hazards due to construction operations or adjacent vehicular traffic. Protective overhead covering shall be provided as necessary to insure protection from falling objects and drip from overhead structures.

In addition to the required openings through falsework, pedestrian facilities shall be provided during pile driving, footing, wall, and other bridge construction operations. At least one walkway shall be available at all times. If the Contractor's operations require the closure of one walkway, then another walkway shall be provided nearby, off the traveled roadway.

Railings shall be constructed of wood, S4S, and shall be painted white. Railings and walkways shall be maintained in good condition. Walkways shall be kept clear of obstructions.

Full compensation for providing pedestrian facilities shall be considered as included in the prices paid for the various contract items of work involved and no additional compensation will be allowed therefor.

Precast concrete members shall not be cast within the right of way of Route 710.

Erection of girders over Atlantic Boulevard, Olympic Boulevard, Whittier Boulevard, and Floral Drive shall be undertaken one span at a time. During girder erection, public traffic in the lanes over which girders are being placed shall be detoured or stopped as specified in this section, "Maintaining Traffic."

Erection and removal of falsework at locations where falsework openings are required shall be undertaken one location at a time. During falsework erection and removal, public traffic in the lanes over which falsework is being erected or removed shall be detoured or stopped as specified in this section, "Maintaining Traffic." Falsework erection shall include adjustments or removal of components that contribute to the horizontal stability of the falsework system. Falsework removal shall include lowering falsework, blowing sand from sand jacks, turning screws on screw jacks, and removing wedges.

The Contractor shall have necessary materials and equipment on the site to erect or remove the girders or the falsework in any one span or over any one opening before detouring or stopping public traffic.

<b>Freeway or Connector Lane Closure Restriction for Designated Legal Holidays and Special Days</b>										
Thu	Fri	Sat	Sun	Mon	Tues	Wed	Thu	Fri	Sat	Sun
x	<b>H</b> xx	xx	xx							
x	xx	<b>H</b> xx	xx							
	x	xx	xx	<b>H</b> xx						
	x			<b>SD</b> xx						
				x	<b>H</b> xx					
					x	<b>H</b> xx				
						x	<b>H</b> xx	xx		xx
Legends:										
	Refer to Charts 1-48									
x	The full width of the traveled way shall be open for use by public traffic by 0500.									
xx	The full width of the traveled way shall be open for use by public traffic.									
<b>H</b>	Designated Legal Holiday									
<b>SD</b>	Special Day									

### **CONSTRUCTION MANAGEMENT PLAN FOR EXTENDED WEEKEND CLOSURES, PREPARATION, APPROVAL, AND UPDATES**

Submit a written request to the Engineer at least 60 days prior to the start of an extended weekend closure.

A Construction Management Plan is required for extended weekend closures as part of the request. The Construction Management Plan must include a general time-scaled logic diagram displaying the major activities and sequence of planned operations that comply with the requirements of these special provisions and a contingency plan at each stage of operations to prevent late opening of extended weekend closures. "Early finish" and "late finish" milestones must be clearly identified for every major activity. The contingency plan must include detailed operations you must undertake should a major activity pass the "late finish" milestone. If you fail to open all lanes to public traffic on time for an extended weekend closure, approvals for Construction Management Plans for remaining extended weekend closures will be considered invalid.

The Engineer will have 15 days to review Construction Management Plans. If revisions are required, as determined by the Engineer, revise and resubmit Construction Management Plans within 15 days of receipt of the Engineer's comments. The Engineer will have 7 days to review revisions. You must not proceed with extended weekend closures unless written approval of final Construction Management Plans is issued by the Engineer 7 days before the planned extended weekend closure.

If you plan consecutive extended weekend closures, revisions of your Management Plan for the immediate subsequent extended weekend closure based upon the progress of the immediately preceding extended weekend closure must be submitted to the Engineer by Tuesday of the subsequent week. You must not proceed with the subsequent extended weekend closure unless written approval of the revision is issued by the Engineer at least one day before the subsequent extended weekend closure.

Attention is directed to the profile index requirements in "Hot Mix Asphalt" of these special provisions.

At the end of extended weekend closures, finish initial hot mix asphalt layers within 4.5 inches below final grade.

Full compensation for preparing, updating, and obtaining written approval of Construction Management Plans for extended weekend closures is considered as included in the lump sum price paid for progress schedule (critical path method) and no separate payment will be made therefor.

Chart No. 1 Freeway Lane Requirements and Hours of Work																									
County: LA					Route/Direction: 5/NB																				
Closure Limits: NB Route 710 Off-connector to NB Route 710 On-connector																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	1	1	1	1	2	S	N	N	N	S	S	S	S	S	S	N	N	N	N	S	3	3	3	2	
Fridays	1	1	1	1	2	S	N	N	N	S	S	S	S	S	S	N	N	N	N	S	S	S	S	3	
Saturdays	2	2	1	1	1	2	3	3	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	3	
Sundays	3	2	1	1	1	1	2	2	3	S	S	S	S	S	S	S	S	S	S	S	S	S	3	2	
Legend:																									
1	Provide at least one through freeway lane open in direction of travel																								
2	Provide at least two adjacent through freeway lanes open in direction of travel																								
3	Provide at least three adjacent through freeway lanes open in direction of travel																								
S	Shoulder closure permitted																								
N	No work permitted																								
REMARKS: Number of Through Traffic Lanes - 4 Provide a slip-ramp to NB Route 710 off-connector as shown on the Traffic Handling Details Plan - Option 2.																									

Chart No. 2 Freeway Lane Requirements and Hours of Work																									
County: LA					Route/Direction: 5/SB																				
Closure Limits: SB Route 710 Off-connector to SB Route 710 On-connector																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	1	1	1	1	1	S	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	S	S	2
Fridays	2	1	1	1	2	S	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	S	S
Saturdays	2	2	2	1	1	2	2	S	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	S	S
Sundays	S	2	2	1	1	1	1	2	2	S	N	N	N	N	N	N	N	N	N	N	N	N	S	S	2
Legend:																									
1	Provide at least one through freeway lane open in direction of travel																								
2	Provide at least two adjacent through freeway lanes open in direction of travel																								
S	Shoulder closure permitted																								
N	No work permitted																								
REMARKS: Number of Through Traffic Lanes - 3 Provide a slip-ramp to SB Route 710 off-connector as shown on the Traffic Handling Details Plan - Option 2.																									

**Chart No. 3  
Freeway Lane Requirements and Hours of Work**

County: LA	Route/Direction: 710/NB																								
Closure Limits: Imperial Hwy On-ramp to NB Route 5 On-connector																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	1	1	1	1	2	S	N	N	N	N	S	S	S	N	N	N	N	N	N	S	3	3	2	2	
Fridays	1	1	1	1	2	S	N	N	N	N	N	N	N	N	N	N	N	N	N	S	3	3	2		
Saturdays	2	1	1	1	1	2	2	3	S	S	S	S	S	S	S	S	S	S	S	S	S	S	3	3	
Sundays	2	2	2	1	1	1	2	2	2	S	S	S	S	S	S	S	S	S	S	S	S	3	3	2	2

Legend:

- 1 Provide at least one through freeway lane open in direction of travel
- 2 Provide at least two adjacent through freeway lanes open in direction of travel
- 3 Provide at least three adjacent through freeway lanes open in direction of travel
- S Shoulder closure permitted
- N No work permitted

REMARKS: Number of Through Traffic Lanes - 3, 3\*, 4, 4\* or 5  
 \* - Traffic lanes outside of the through traffic lanes delineated with a double line of pavement markers as shown on "Pavement Markers and Traffic Lines Typical Details (Detail 37 series)," may be closed at the same time as adjacent connector or ramp is allowed to be closed as shown on Charts 38 and 64.

Chart No. 4 Freeway Lane Requirements and Hours of Work																									
County: LA					Route/Direction: 710/NB																				
Closure Limits: North of NB Route 5 On-connector to Route 60 On-connector																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	1	1	1	1	1	3	N	N	N	S	S	S	S	S	N	N	N	N	N	S	3	3	2	2	
Fridays	1	1	1	1	1	3	N	N	N	S	S	S	S	N	N	N	N	N	S	S	3	3	2		
Saturdays	2	1	1	1	1	1	2	3	3	3	S	S	S	S	S	S	S	S	S	S	3	3	3	2	
Sundays	2	1	1	1	1	1	1	2	2	3	3	3	S	S	S	S	S	S	S	3	3	3	2	2	

Legend:

1 Provide at least one through freeway lane open in direction of travel

2 Provide at least two adjacent through freeway lanes open in direction of travel

3 Provide at least three adjacent through freeway lanes open in direction of travel

S Shoulder closure permitted

N No work permitted

REMARKS: Number of Through Traffic Lanes – 3, 4 or 4\*  
 \* - Traffic lanes outside of the through traffic lanes delineated with a double line of pavement markers as shown on "Pavement Markers and Traffic Lines Typical Details (Detail 37 series)," may be closed at the same time as adjacent connector or ramp is allowed to be closed as shown on Charts 44 and 70.

Chart No. 5 Freeway Lane Requirements and Hours of Work																									
County: LA					Route/Direction: 710/NB																				
Closure Limits: North of Route 60 On-connector to Route 10 Sep																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	1	1	1	1	1	2	N	N	N	S	S	S	S	S	S	N	N	N	N	S	2	2	2	1	
Fridays	1	1	1	1	1	2	N	N	N	S	S	S	S	S	S	N	N	N	N	S	S	2	2	2	
Saturdays	1	1	1	1	1	1	1	2	2	2	S	S	S	S	S	S	S	S	S	S	2	2	2	2	
Sundays	1	1	1	1	1	1	1	1	1	2	2	2	S	S	S	S	S	S	2	2	2	2	2	1	

Legend:

1 Provide at least one through freeway lane open in direction of travel

2 Provide at least two adjacent through freeway lanes open in direction of travel

S Shoulder closure permitted

N No work permitted

REMARKS: Number of Through Traffic Lanes – 2, 2\*, 3 or 4  
 \* - Traffic lanes outside of the through traffic lanes delineated with a double line of pavement markers as shown on "Pavement Markers and Traffic Lines Typical Details (Detail 37 series)," may be closed at the same time as adjacent connector is allowed to be closed as shown on Chart 48.

**Chart No. 6  
Freeway Lane Requirements and Hours of Work**

County: LA	Route/Direction: 710/SB																								
Closure Limits: Route 10 Sep to Route 60 On-connector																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	1	1	1	1	1	2	N	N	N	S	S	S	S	S	N	N	N	N	N	S	2	2	2	1	
Fridays	1	1	1	1	1	2	N	N	N	S	S	S	S	S	N	N	N	N	N	S	S	2	2	2	
Saturdays	2	1	1	1	1	1	2	2	2	S	S	S	S	S	S	S	S	S	S	2	2	2	2	2	
Sundays	2	1	1	1	1	1	1	1	1	2	2	2	2	S	S	S	S	2	2	2	2	2	1	1	

Legend:

- 1 Provide at least one through freeway lane open in direction of travel
- 2 Provide at least two adjacent through freeway lanes open in direction of travel
- S Shoulder closure permitted
- N No work permitted

REMARKS: Number of Through Traffic Lanes – 3 or 3\*  
 \* - Traffic lanes outside of the through traffic lanes delineated with a double line of pavement markers as shown on "Pavement Markers and Traffic Lines Typical Details (Detail 37 series)," may be closed at the same time as adjacent ramp is allowed to be closed as shown on Charts 75 and 76.

**Chart No. 7  
Freeway Lane Requirements and Hours of Work**

County: LA	Route/Direction: 710/SB																								
Closure Limits: South of Route 60 On-connector to Route 5 On-connector																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	1	1	1	1	2	S	N	N	N	N	N	N	N	N	N	N	N	N	N	N	S	S	2	1	
Fridays	1	1	1	1	2	S	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	S	2	2	
Saturdays	2	1	1	1	1	2	2	S	S	S	N	N	N	N	N	N	N	N	N	S	S	S	S	2	
Sundays	2	1	1	1	1	1	1	2	2	2	S	S	S	N	N	N	N	N	S	S	S	S	2	1	

Legend:

- 1 Provide at least one through freeway lane open in direction of travel
- 2 Provide at least two adjacent through freeway lanes open in direction of travel
- S Shoulder closure permitted
- N No work permitted

REMARKS: Number of Through Traffic Lanes – 3 , 3\* or 4  
 \* - Traffic lanes outside of the through traffic lanes delineated with a double line of pavement markers as shown on "Pavement Markers and Traffic Lines Typical Details (Detail 37 series)," may be closed at the same time as adjacent connector or adjacent ramp is allowed to be closed as shown on Charts 39 and 71.

**Chart No. 8  
Freeway Lane Requirements and Hours of Work**

County: LA	Route/Direction: 710/SB																								
Closure Limits: South of Route 5 On-connector to WB Imperial Hwy Off-ramp																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	1	1	1	1	2	4	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	4	3	3	2
Fridays	2	1	1	1	2	3	N	N	N	N	N	N	N	N	N	N	N	N	N	S	4	4	3	3	
Saturdays	2	2	2	1	1	2	2	3	4	4	4	N	N	N	N	N	N	N	4	4	4	4	4	3	
Sundays	2	2	2	1	1	1	2	2	2	3	4	4	4	4	4	S	4	4	4	4	4	3	3	2	

Legend:

- |   |
|---|
| 1 |
|---|

 Provide at least one through freeway lane open in direction of travel
- |   |
|---|
| 2 |
|---|

 Provide at least two adjacent through freeway lanes open in direction of travel
- |   |
|---|
| 3 |
|---|

 Provide at least three adjacent through freeway lanes open in direction of travel
- |   |
|---|
| 4 |
|---|

 Provide at least four adjacent through freeway lanes open in direction of travel
- |   |
|---|
| S |
|---|

 Shoulder closure permitted
- |   |
|---|
| N |
|---|

 No work permitted

REMARKS: Number of Through Traffic Lanes – 4, 4\* or 5  
 \* - Traffic lanes outside of the through traffic lanes delineated with a double line of pavement markers as shown on "Pavement Markers and Traffic Lines Typical Details (Detail 37 series)," may be closed at the same time as adjacent ramp is allowed to be closed as shown on Chart 66.

**Chart No. 9  
Freeway Lane Requirements and Hours of Work**

County: LA	Route/Direction: 710/NB																								
Closure Limits: Olympic Blvd Off-ramp to 3rd St On-ramp																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	2	2	2	2	2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Fridays	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	2
Saturdays	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Sundays	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Legend:

- |   |
|---|
| 2 |
|---|

 Provide at least two adjacent through freeway lanes open in direction of travel
- |   |
|---|
| N |
|---|

 No work permitted

**REMARKS: (Pre-Cast Concrete Panel Installation)**  
 When re-striping operation is required prior to and after panel installation, close NB Route 710 as shown on Chart 20.

Place a portable changeable message sign on the right shoulder of NB Route 710 just south of Compton Blvd OC with the message: "2 LANES/ONLY - RTE 5/TO/RTE 60". Place a second portable changeable message sign on the right shoulder of NB Route 710 just north of Slauson Ave UP with the message: "2 LANES/ONLY - RTE 5/TO/RTE 60".

Provide a slip-ramp to Route 60 off-connector.  
 Close NB Route 5 to NB Route 710 connector and detour traffic as shown on Chart 36 (Alternate Detour 2).  
 Close Olympic Blvd on-ramp.

When work requires Route 60 off-connector to be closed, place a third portable changeable message sign on NB Route 710 at the gore of Florence Ave off-ramp with the message: "RTE 60/EXITS/CLOSED" and detour traffic as shown on Chart 44 (Alternate Detour 1).

**Chart No. 10  
Freeway Lane Requirements and Hours of Work**

County: LA	Route/Direction: 710/NB																									
Closure Limits: Cesar Chavez Ave Off-ramp to EB Route 10 On-connector																										
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Mondays through Thursdays	2	2	2	2	2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Fridays	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	2
Saturdays	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Sundays	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Legend:

2 Provide at least two adjacent through freeway lanes open in direction of travel

N No work permitted

**REMARKS: (Pre-Cast Concrete Panel Installation)**

When re-striping operation is required prior to and after panel installation, close NB Route 710 as shown on Chart 26.

Place a portable changeable message sign on the right shoulder of NB Route 710 between the Washington Blvd ramps with the message: "2 LANES/ONLY - RTE 60/TO/RTE 10". Place a second portable changeable message sign on the right shoulder of NB Route 710 at the gore of Olympic Blvd on-ramp with the message: "2 LANES/ONLY/AHEAD - RTE 60/TO/RTE 10". Place a third portable changeable message sign on EB Route 10 at the gore of Santa Fe Ave off-ramp with the message: "N 710/CLOSED - RTE 60/TO/RTE 10". Place a fourth portable changeable message sign on EB Route 60 at the gore of Lorena St on-ramp with the message: "N 710/CLOSED - RTE 60/TO/RTE 10". Place a fifth portable changeable message sign on the right shoulder of WB Route 60 between the Atlantic Blvd off-ramp and the NB Atlantic Blvd on-ramp with the message: "N 710/CLOSED - RTE 60/TO/RTE 10".

Close EB Route 60 to NB Route 710 connector and detour traffic as shown on Chart 40 (Alternate Detour 3).

Close WB Route 60 to NB Route 710 connector and detour traffic as shown on Chart 42 (Alternate Detour 3).

Close Floral Dr on-ramp.

**Chart No. 11  
Freeway Lane Requirements and Hours of Work**

County: LA	Route/Direction: 710/SB																								
Closure Limits: Route 10 Sep to south of Route 60 Off-connector																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	2	2	2	2	2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Fridays	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	2	2
Saturdays	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Sundays	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Legend:

- |   |
|---|
| 2 |
|---|

 Provide at least two adjacent through freeway lanes open in direction of travel
- |   |
|---|
| N |
|---|

 No work permitted

**REMARKS: (Pre-Cast Concrete Panel Installation)**  
 Place a portable changeable message sign on the right shoulder of SB Route 710 approximately 300 feet north of Hellman Ave OC with the message: "2 LANES/ONLY - RTE 10/TO/RTE 60". Place a second portable changeable message sign on the right shoulder of EB Route 10 approximately 500 feet west of City Terrace POC with the message: "S 710/CLOSED - RTE 10/TO/RTE 60".  
 Provide a slip-ramp to Route 60 off-connector.  
 Close EB Route 10 to SB Route 710 connector and detour traffic as shown on Chart 46 (Alternate Detour 1).  
 Close WB Route 10 to SB Route 710 connector and detour traffic as shown on Chart 47 (Alternate Detour 3).  
 Close Ramona Blvd on-ramp.

When work requires Route 60 off-connector to be closed, place a third portable changeable message sign on the right shoulder of SB Route 710 approximately 600 feet south of the Valley Blvd on-ramp intersection with the message: "RTE 60/EXITS/CLOSED" and detour traffic as shown on Chart 45 (Alternate Detour 3).

**Chart No. 12  
Freeway Lane Requirements and Hours of Work**

County: LA	Route/Direction: 710/SB																								
Closure Limits: Route 60 Off-connector to Olympic On-ramp																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	2	2	2	2	2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Fridays	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	2	2
Saturdays	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Sundays	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	

Legend:

- |   |
|---|
| 2 |
|---|

 Provide at least two adjacent through freeway lanes open in direction of travel
- |   |
|---|
| N |
|---|

 No work permitted

**REMARKS: (Pre-Cast Concrete Panel Installation)**  
 Place a portable changeable message sign on the right shoulder of SB Route 710 approximately 300 feet north of Hellman Ave OC with the message: "2 LANES/ONLY - RTE 60/TO/RTE 5". Place a second portable changeable message sign on the right shoulder of SB Route 710 approximately 500 feet north of Floral Dr off-ramp with the message: "2 LANES/ONLY - RTE 60/TO/RTE 5". Place a third portable changeable message sign on EB Route 10 at the gore of Santa Fe Ave off-ramp with the message: "S 710/CLOSED - RTE 60/TO/RTE 5". Place a fourth portable changeable message sign on EB Route 60 at the gore of Lorena St on-ramp with the message: "S 710/CLOSED - RTE 60/TO/RTE 5". Place a fifth portable changeable message sign on the right shoulder of WB Route 60 between the Atlantic Blvd off-ramp and the NB Atlantic Blvd on-ramp with the message: "S 710/CLOSED - RTE 60/TO/RTE 5".  
 Provide a slip-ramp to Route 60 off-connector.  
 Close EB Route 60 to SB Route 710 connector and detour traffic as shown on Chart 41.  
 Close WB Route 60 to SB Route 710 connector and detour traffic as shown on Chart 43.  
 Close Cesar Chavez Ave and 3rd St on-ramps.

When work requires Route 60 off-connector to be closed, place a third portable changeable message sign on the right shoulder of SB Route 710 approximately 600 feet south of the Valley Blvd on-ramp intersection with the message: "RTE 60/EXITS/CLOSED" and detour traffic as shown on Chart 45 (Alternate Detour 3).

Chart No. 13 Freeway Lane Requirements and Hours of Work																										
County: LA					Route/Direction: 710/SB																					
Closure Limits: Bandini Blvd UC to Atlantic Blvd UC																										
FROM HOUR TO HOUR																										
24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24																										
Mondays through Thursdays					N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
Fridays					N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	2	2
Saturdays					2	2	2	2	2	2	2	2	N	N	N	N	N	N	N	N	N	N	N	N	2	2
Sundays					2	2	2	2	2	2	2	2	2	2	N	N	N	N	N	N	N	N	N	N	N	N
Legend:																										
2 Provide at least two adjacent through freeway lanes open in direction of travel																										
N No work permitted																										
REMARKS: <b>(Pre-Cast Concrete Panel Installation)</b> Place a portable changeable message sign as shown on the Traffic Handling Details Plan. Close Washington Blvd on-ramp.																										

Chart No. 14 Complete Freeway Closure Hours																										
County: LA					Route/Direction: 5/NB																					
Closure Limits: NB Route 710 Off-connector to NB Route 710 On-connector																										
FROM HOUR TO HOUR																										
24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24																										
Mondays through Thursdays					C	C	C	C	C																	C
Fridays					C	C	C	C	C																	
Saturdays						C	C	C	C	C																
Sundays						C	C	C	C	C	C															
Legend:																										
C Freeway may be closed completely																										
No complete freeway closure is permitted																										
REMARKS: Detour traffic to exit at NB Route 710 off-connector; north on Route 710 to west Route 60. Place a portable changeable message sign on the right shoulder of NB Route 5 at the gore of Atlantic Blvd (North) off-ramp with the message: "FREEWAY/CLOSED/AHEAD - USE/N710 TO/W60". Place a second portable changeable message sign on NB Route 710 at the Olympic Blvd on-ramp gore with the message: "N5/DETOUR/TRAFFIC - USE/W60". Close SB Atlantic Blvd on-ramp.																										

Chart No. 15 Complete Freeway Closure Hours																										
County: LA					Route/Direction: 5/SB																					
Closure Limits: SB Route 710 Off-connector to Triggs St On-ramp																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C																				C
Fridays		C	C	C	C	C																				
Saturdays			C	C	C	C	C	C																		
Sundays				C	C	C	C	C	C																	
Legend:																										
C		Freeway may be closed completely																								
		No complete freeway closure is permitted																								
REMARKS:																										
Detour traffic onto SB Route 710 and exit at Washington Blvd off-ramp; east on Washington Blvd to the on-ramp to SB Route 5. Place a portable changeable message sign on the right shoulder of SB Route 5 between the Indiana St ramps with the message: "FREEWAY/CLOSED – AT/RTE 710". Place a second portable changeable message sign on the right shoulder of SB Route 5 between the Ditman Ave ramps with the message: "FREEWAY/CLOSED/AHEAD – DETOUR/S710 TO/WASHNGTN". A minimum of 12 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																										
Close SB Route 710 to SB Route 5 connector and detour traffic as shown on Chart 39 (Alternate Detour 2).																										

Chart No. 16 Complete Freeway Closure Hours																										
County: LA					Route/Direction: 710/NB																					
Closure Limits: Imperial Hwy Off-ramp to Firestone Blvd On-ramp																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C																					
Fridays			C	C	C	C																				
Saturdays			C	C	C	C	C																			
Sundays				C	C	C	C	C																		
Legend:																										
C		Freeway may be closed completely																								
		No complete freeway closure is permitted																								
REMARKS:																										
Detour traffic to exit at Imperial Hwy (East) off-ramp; east on Imperial Hwy; north on Garfield Ave; west on Firestone Blvd to the on-ramp to NB Route 710. Place a portable changeable message sign on the right shoulder of NB Route 710 in advance of the Compton Blvd OC with the message: "FREEWAY/CLOSED/AHEAD – IMPERIAL/TO/FIRESTNE ". A minimum of 9 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																										
Close Imperial Hwy on-ramps.																										

Chart No. 17 Complete Freeway Closure Hours																									
County: LA					Route/Direction: 710/NB																				
Closure Limits: Florence Ave Off-ramp to NB Atlantic Blvd On-ramp																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C																					
Fridays	C	C	C	C																					
Saturdays	C	C	C	C	C																				
Sundays			C	C	C	C																			
Legend:																									
<input type="checkbox"/> C Freeway may be closed completely <input type="checkbox"/> No complete freeway closure is permitted																									
REMARKS: Detour traffic to exit at Florence Ave (East) off-ramp; north on Garfield Ave; east on Telegraph Rd to the on-ramp to NB Route 5 to NB Route 710. Place a portable changeable message sign on the right shoulder of NB Route 710 in the gore area of WB Imperial Hwy on-ramp with the message: "FREEWAY/CLOSED/AHEAD – FLORENCE/TO/ATLANTIC". A minimum of 19 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure. Close Florence Ave on-ramps.																									

Chart No. 18 Complete Freeway Closure Hours																									
County: LA					Route/Direction: 710/NB																				
Closure Limits: NB Atlantic Blvd Off-ramp to NB Atlantic Blvd On-ramp																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C																					
Fridays	C	C	C	C																					
Saturdays																									
Sundays					C	C	C																		
Legend:																									
<input type="checkbox"/> C Freeway may be closed completely <input type="checkbox"/> No complete freeway closure is permitted																									
REMARKS: Detour traffic to exit at Atlantic Blvd (north) off-ramp; continue north on Atlantic Blvd; west on Washington Blvd to the on-ramp to NB Route 710. Place a portable changeable message sign on the right shoulder of NB Route 710 in the gore area of WB Imperial Hwy on-ramp with the message: "FREEWAY/CLOSED/AHEAD – FLORENCE/TO/ATLANTIC". A minimum of 4 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure. Close Florence Ave on-ramps.																									

Chart No. 19 Complete Freeway Closure Hours																									
County: LA					Route/Direction: 710/NB																				
Closure Limits: Washington Blvd Off-ramp to Olympic Blvd Off-ramp																									
FROM HOUR TO HOUR																									
24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24																									
Mondays through Thursdays					C	C	C	C																	
Fridays					C	C	C	C																	
Saturdays																									
Sundays								C	C	C															
Legend:																									
<input type="checkbox"/> C Freeway may be closed completely <input type="checkbox"/> No complete freeway closure is permitted																									
REMARKS:																									
Detour traffic to exit at Washington Blvd off-ramp; east on Washington Blvd; north on Atlantic Blvd; west on Olympic Blvd to the on-ramp to NB Route 710. Place a portable changeable message sign on the right shoulder of NB Route 710 just north of Slauson Ave UP with the message: "FREEWAY/CLOSED/AHEAD – WASHNGTN/TO/ROUTE 5". A minimum of 21 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure. Close Washington Blvd on-ramp.																									

Chart No. 20 Complete Freeway Closure Hours																										
County: LA					Route/Direction: 710/NB																					
Closure Limits: NB Route 5 Off-connector to 3rd St On-ramp																										
FROM HOUR TO HOUR																										
24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24																										
Mondays through Thursdays					C	C	C	C	C																	
Fridays					C	C	C	C	C																	
Saturdays					C	C	C	C	C																	
Sundays						C	C	C	C	C	C															C
Legend:																										
<input type="checkbox"/> C Freeway may be closed completely <input type="checkbox"/> No complete freeway closure is permitted																										
REMARKS:																										
Detour traffic onto NB Route 5 and exit at Grande Vista Ave off-ramp; east on Atlantic St; north on Lorena St to the on-ramp to EB Route 60 to NB Route 710. Place a portable changeable message sign on NB Route 710 at NB Atlantic Blvd/EB Bandini Blvd off-ramp gore with the message: "FREEWAY/CLOSED/AHEAD – USE N5/TO GRNDE/VISTA". Place a second portable changeable message sign on the right shoulder of NB Route 5 just south of Eastman Ave POC with the message: "N 710/DETOUR/TRAFFIC - EXIT AT/GRANDE/VISTA". A minimum of 9 special freeway detour signs (SP-2), as shown on plans, and 2 SP-7 signs on NB Lorena St in advance of the on-ramp to EB Route 60, shall be posted along the detour route and shall be removed at the end of each closure. Close Washington Blvd and Olympic Blvd on-ramps.																										

**Chart No. 21  
Complete Freeway Closure Hours**

County: LA	Route/Direction: 710/NB																									
Closure Limits: Olympic Blvd Off-ramp to Olympic Blvd On-ramp																										
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Mondays through Thursdays		C	C	C																						
Fridays		C	C	C																						
Saturdays																										
Sundays				C	C	C																				

Legend:

C Freeway may be closed completely

No complete freeway closure is permitted

REMARKS:  
 Detour traffic to exit at Olympic Blvd off-ramp; west on Olympic Blvd to the on-ramp to NB Route 710. Place a portable changeable message sign on the right shoulder of NB Route 710 in the gore area of the Atlantic Blvd off-ramp with the message: "FREEWAY/CLOSED – AT/OLYMPIC". A minimum of 3 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.  
 Close NB Route 5 to NB Route 710 connector and detour traffic as shown on Chart 36 (Alternate Detour 1).

**Chart No. 22  
Complete Freeway Closure Hours**

County: LA	Route/Direction: 710/NB																									
Closure Limits: Olympic Blvd Off-ramp to 3rd St On-ramp																										
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Mondays through Thursdays	C	C	C	C	C																					
Fridays	C	C	C	C	C																					
Saturdays	C	C	C	C	C	C																				
Sundays		C	C	C	C	C	C																			C

Legend:

C Freeway may be closed completely

No complete freeway closure is permitted

**REMARKS:**

Detour traffic to exit at Olympic Blvd off-ramp; west on Olympic Blvd; north on Eastern Ave; direct NB Route 710 traffic east on 3rd St; south on Ford Blvd to the on-ramp to NB Route 710, and direct Route 60 traffic west on 3rd St to the on-ramps to Route 60. Place a portable changeable message sign on the right shoulder of NB Route 710 in the gore area of the Atlantic Blvd off-ramp with the message: "FREEWAY/CLOSED/AHEAD – OLYMPIC/TO/3RD ST". A minimum of 11 special freeway detour signs (SP-2), as shown on plans, and 2 SP-7 on NB Eastern Ave in advance of 3rd St, shall be posted along the detour route and shall be removed at the end of each closure.

Provide a slip-ramp to NB Route 5 off-connector as shown on the Traffic Handling Details Plan - Option 2. Close NB Route 5 to NB Route 710 connector and detour traffic as shown on Chart 36 (Alternate Detour 2). Close Olympic Blvd on-ramp.

<b>Chart No. 23</b>																										
<b>Complete Freeway Closure Hours</b>																										
County: LA					Route/Direction: 710/NB																					
Closure Limits: Route 60 Off-connector to Floral Dr																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C																				
Fridays		C	C	C	C	C																				
Saturdays			C	C	C	C	C																			
Sundays				C	C	C	C	C	C																	
Legend:																										
<input type="checkbox"/> C		Freeway may be closed completely																								
<input type="checkbox"/>		No complete freeway closure is permitted																								
REMARKS:																										
Detour traffic onto WB Route 60 and exit at Downey Rd off-ramp; east on 3rd St; north on Ford St to the on-ramp to NB Route 710. Place a portable changeable message sign on the right shoulder of NB Route 710 just north of East Yard OH with the message: "FREEWAY/CLOSED/AHEAD – RTE 60/TO/FLORAL". Place a second portable changeable message sign on NB Route 710 at the Olympic Blvd on-ramp gore with the message: "FREEWAY/CLOSED/AHEAD – DETOUR/W60 TO/DOWNEY".																										
Close EB Route 10 to NB Route 710 and detour traffic as shown on Chart 40 (Alternate Detour 2).																										
Close WB Route 10 to NB Route 710 and detour traffic as shown on Chart 42 (Alternate Detour 2).																										
Close 3rd St on-ramp.																										

<b>Chart No. 24</b>																										
<b>Complete Freeway Closure Hours</b>																										
County: LA					Route/Direction: 710/NB																					
Closure Limits: 3rd St Off-ramp to Floral Ave On-ramp																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C																				
Fridays		C	C	C	C	C																				
Saturdays			C	C	C	C	C																			
Sundays				C	C	C	C	C	C																	C
Legend:																										
<input type="checkbox"/> C		Freeway may be closed completely																								
<input type="checkbox"/>		No complete freeway closure is permitted																								
REMARKS:																										
Detour traffic to exit at 3rd St off-ramp; north on Ford Blvd to the on-ramp to NB Route 710. Place a portable changeable message sign on the right shoulder of NB Route 710 in the gore area of the Olympic Blvd on-ramp with the message: "FREEWAY/CLOSED/AHEAD – 3RD ST/TO/FLORAL". A minimum of 7 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																										
Close 3rd St on-ramp.																										

**Chart No. 25  
Complete Freeway Closure Hours**

County: LA	Route/Direction: 710/NB																									
Closure Limits: Cesar Chavez Ave Off-ramp to Floral Ave On-ramp																										
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Mondays through Thursdays	C	C	C	C	C																					
Fridays	C	C	C	C	C																					
Saturdays		C	C	C	C	C																				
Sundays			C	C	C	C	C	C																		C

Legend:

C Freeway may be closed completely

No complete freeway closure is permitted

**REMARKS:**

Detour traffic to exit at Cesar Chavez Ave off-ramp; north on Ford Blvd to the on-ramp to NB Route 710. Place a portable changeable message sign on the right shoulder of NB Route 710 in the gore area of the Olympic Blvd on-ramp with the message: "FREEWAY/CLOSED/AHEAD – C CHAVEZ/TO/FLORAL". A minimum of 4 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

Close EB Route 60 to NB Route 710 connector and detour traffic as shown on Chart 40 (Alternate Detour 2).

Close WB Route 60 to NB Route 710 connector and detour traffic as shown on Chart 42 (Alternate Detour 2).

**Chart No. 26  
Complete Freeway Closure Hours**

County: LA	Route/Direction: 710/NB																									
Closure Limits: Cesar Chavez Ave Off-ramp to EB Route 10 On-connector																										
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Mondays through Thursdays	C	C	C	C	C																					
Fridays	C	C	C	C	C																					
Saturdays		C	C	C	C	C																				
Sundays			C	C	C	C	C	C																		C

Legend:

C Freeway may be closed completely

No complete freeway closure is permitted

**REMARKS:**

Detour traffic to exit at Cesar Chavez Ave off-ramp; north on Ford Blvd; west on Cesar Chavez Ave; north on Eastern Ave to the on-ramps to NB Route 710 and Route 10. Place a portable changeable message sign on the right shoulder of NB Route 710 in the gore area of Olympic Blvd on-ramp with the message: "FREEWAY/CLOSED/AHEAD – C CHAVEZ/TO/RTE 10". A minimum of 10 special freeway detour signs (SP-2), as shown on plans, and 2 SP-6 on NB Eastern Ave in advance of Ramona Blvd, shall be posted along the detour route and shall be removed at the end of each closure.

Close EB Route 60 to NB Route 710 connector and detour traffic as shown on Chart 40 (Alternate Detour 3).  
 Close WB Route 60 to NB Route 710 connector and detour traffic as shown on Chart 42 (Alternate Detour 3).  
 Close Floral Ave On-ramp.

**Chart No. 27  
Complete Freeway Closure Hours**

County: LA	Route/Direction: 710/NB																								
Closure Limits: Ramona Blvd Off-ramp to EB Route 10 On-connector																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C																				C
Fridays	C	C	C	C	C																				
Saturdays	C	C	C	C	C	C																			
Sundays		C	C	C	C	C	C	C																	C

Legend:

- C Freeway may be closed completely
- No complete freeway closure is permitted

**REMARKS:**  
 Detour traffic to exit at Ramona Blvd off-ramp; north on Corporate Center Dr; west on Ramona Blvd to the on-ramps to Route 710 and Route 10. Place a portable changeable message sign on the right shoulder of NB Route 710 between the 3rd St ramps with the message: "FREEWAY/CLOSED/AHEAD – RAMONA/TO/RTE 10". A minimum of 7 special freeway detour signs (SP-2), as shown on plans, and 4 SP-6 on WB Ramona Blvd in advance of Campus Rd and Eastern Ave, shall be posted along the detour route and shall be removed at the end of each closure.

**Chart No. 28  
Complete Freeway Closure Hours**

County: LA	Route/Direction: 710/SB																									
Closure Limits: WB Route 10 Off-connector to Route 60 On-connector																										
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Mondays through Thursdays	C	C	C	C	C																					
Fridays	C	C	C	C	C																					
Saturdays		C	C	C	C	C																				
Sundays		C	C	C	C	C	C																			

Legend:

- C Freeway may be closed completely
- No complete freeway closure is permitted

**REMARKS:**

Detour traffic onto EB Route 10 and exit at Fremont Ave off-ramp; south on Fremont Ave; continue south on Monterrey Pass Rd; continue south on Mednick Ave; west on 3rd St; direct SB Route 710 traffic south on Eastern Ave to the on-ramp to SB Route 710 and direct Route 60 traffic to continue west on 3rd St to the on-ramps to Route 60. Direct SB Route 5 traffic to continue south on Eastern Ave; west on Olympic Blvd; north on Ditman Ave to the on-ramp to SB Route 5. Place a portable changeable message sign on the right shoulder of SB Route 710 approximately 600 feet south of Valley Blvd on-ramp intersection with the message: "FREEWAY/CLOSED/AHEAD – RTE 10/TO/RTE 60". Place a second portable changeable message sign on the right shoulder of SB Route 710 just north of Hellman Ave OC with the message: "FREEWAY/CLOSED/AHEAD - USE E10/TO/FREMONT". A minimum of 30 special freeway detour signs (SP-2), as shown on plans, 2 SP-6 on WB 3rd St in advance of Eastern Ave, and 1 SP-7 on SB Eastern Ave in advance of the on-ramp to SB Route 710 shall be posted along the detour route and shall be removed at the end of each closure.

Close EB Route 10 to SB Route 710 and detour traffic as shown on Chart 46 (Alternate Detour 3).  
 Close WB Route 10 to SB Route 710 and detour traffic as shown on Chart 47 (Alternate Detour 4).  
 Close Ramona Blvd, Cesar Chavez Ave, and 3rd St on-ramps.

**Chart No. 29  
Complete Freeway Closure Hours**

County: LA	Route/Direction: 710/SB																									
Closure Limits: Floral Dr/Cesar Chavez Ave Off-ramp to 3rd St On-ramp																										
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Mondays through Thursdays	C	C	C	C	C																					C
Fridays	C	C	C	C	C																					
Saturdays		C	C	C	C	C																				
Sundays		C	C	C	C	C	C	C																		C

Legend:

- C Freeway may be closed completely
- No complete freeway closure is permitted

**REMARKS:**  
 Detour traffic to exit at Floral Dr/Cesar Chavez Ave off-ramp; east on Floral Dr; south on Ford Blvd; west on 3rd St to the on-ramp to SB Route 710. Place a portable changeable message sign on the right shoulder of SB Route 710 just south Hellman Ave OC with the message: "S 710/CLOSED – AT/C CHAVEZ". A minimum of 6 special freeway detour signs (SP-2), as shown on plans, and 2 SP-7 signs on EB Floral Dr in advance of the Route 60 on-ramp and Floral Dr, shall be posted along the detour route and shall be removed at the end of each closure.  
 Close Cesar Chavez on-ramp.

**Chart No. 30  
Complete Freeway Closure Hours**

County: LA	Route/Direction: 710/SB																									
Closure Limits: Route 60 Off-connector to Olympic Blvd/Eastern Ave On-ramp																										
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Mondays through Thursdays	C	C	C	C	C																					
Fridays	C	C	C	C																						
Saturdays		C	C	C	C																					
Sundays			C	C	C	C	C																			

Legend:

- C Freeway may be closed completely
- No complete freeway closure is permitted

**REMARKS:**

Close freeway at the off-connector to Route 60. Detour traffic onto WB Route 60 and exit at Downey Rd off-ramp; east on 3rd St; south on Eastern Ave to the on-ramp to SB Route 710. Direct SB Route 5 traffic to continue south on Eastern Ave; west on Olympic Blvd; north on Ditman Ave to the on-ramp to SB Route 5. Place a portable changeable message sign on the right shoulder of SB Route 710 in the gore area of Ramona Blvd on-ramp with the message: "FREEWAY/CLOSED/AHEAD – C CHAVEZ/TO/RTE 5. Place a portable changeable message sign on the right shoulder of SB Route 710 just north of Floral Dr/Cesar Chavez Ave off-ramp with the message: "FREEWAY/CLOSED/AHEAD - DETOUR/W60 TO/DOWNEY". A minimum of 17 special freeway detour signs (SP-2), as shown on plans, and 2 SP-7 signs on SB Eastern Ave in advance of SB Route 710 on-ramp and Olympic Blvd, shall be posted along the detour route and shall be removed at the end of each closure.

Close EB Route 60 to SB Route 710 connector and detour traffic per Chart 41.  
 Close WB Route 60 to SB Route 710 connector and detour traffic per Chart 43.  
 Close Cesar Chavez and 3rd St on-ramps.

Chart No. 31 Complete Freeway Closure Hours																									
County: LA					Route/Direction: 710/SB																				
Closure Limits: Whittier Blvd/Olympic Blvd Off-ramp to Route 5 On-connector																									
FROM HOUR TO HOUR 24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24																									
Mondays through Thursdays					C	C	C	C																	
Fridays					C	C	C	C																	
Saturdays						C	C	C	C																
Sundays							C	C	C	C	C														
Legend:																									
<input type="checkbox"/> C Freeway may be closed completely <input type="checkbox"/> No complete freeway closure is permitted																									
REMARKS: Detour traffic to exit at Whittier Blvd/Olympic Blvd off-ramp; south on Eastern Ave; west on Olympic Blvd; north on Ditman Ave to the on-ramp to SB Route 5 to SB Route 710. Place a portable changeable message sign on the left shoulder of SB Route 710 just north of 1st St OC with the message: "FREEWAY/CLOSED/AHEAD – OLYMPIC/TO/ROUTE 5". A minimum of 12 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure. Close Olympic Blvd/Eastern Ave on-ramp.																									

Chart No. 32 Complete Freeway Closure Hours																									
County: LA					Route/Direction: 710/SB																				
Closure Limits: Atlantic Blvd Off-ramp to Atlantic Blvd On-ramp																									
FROM HOUR TO HOUR 24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24																									
Mondays through Thursdays						C	C	C																	
Fridays						C	C	C																	
Saturdays																									
Sundays								C	C	C															
Legend:																									
<input type="checkbox"/> C Freeway may be closed completely <input type="checkbox"/> No complete freeway closure is permitted																									
REMARKS: Detour traffic to exit at Atlantic Blvd off-ramp towards Bandini Blvd; east on Bandini Blvd; south on Atlantic Blvd to the on-ramp to SB Route 710. Place a portable changeable message sign on the right shoulder of SB Route 710 just south of SB Route 5 on-connector with the message: "FREEWAY/CLOSD AT/ATLANTIC – DETOUR/TO/BANDINI". A minimum of 7 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																									

Chart No. 33 Complete Freeway Closure Hours																										
County: LA					Route/Direction: 710/SB																					
Closure Limits: Atlantic Blvd Off-ramp to Florence Ave On-ramp																										
FROM HOUR TO HOUR																										
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Mondays through Thursdays			C	C	C																					
Fridays			C	C	C																					
Saturdays																										
Sundays					C	C	C																			
Legend:																										
<input type="checkbox"/> C Freeway may be closed completely <input type="checkbox"/> No complete freeway closure is permitted																										
REMARKS: Detour traffic to exit at Atlantic Blvd off-ramp; south on Atlantic Blvd; east on Florence Ave to the on-ramp to SB Route 710. Place a portable changeable message sign on the right shoulder of SB Route 710 just south of SB Route 5 on-connector with the message: "FREEWAY/CLOSED/AHEAD – ATLANTIC/TO/FLORENCE". A minimum of 17 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure. Close Atlantic Blvd on-ramps.																										

Chart No. 34 Complete Freeway Closure Hours																										
County: LA					Route/Direction: 710/SB																					
Closure Limits: Atlantic Blvd Off-ramp to Florence Ave On-ramp																										
FROM HOUR TO HOUR																										
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Mondays through Thursdays	C	C	C	C	C																					C
Fridays	C	C	C	C	C																					
Saturdays			C	C	C	C	C																			
Sundays			C	C	C	C	C	C																		
Legend:																										
<input type="checkbox"/> C Freeway may be closed completely <input type="checkbox"/> No complete freeway closure is permitted																										
REMARKS: Detour traffic to exit at Atlantic Blvd off-ramp; south on Atlantic Blvd; east on Florence Ave to the on-ramp to SB Route 710. Place a portable changeable message sign on the right shoulder of SB Route 710 just south of SB Route 5 on-connector with the message: "FREEWAY/CLOSED/AHEAD – ATLANTIC/TO/FLORENCE". A minimum of 17 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure. Close SB Route 5 to SB Route 710 connector and detour traffic as shown on Chart 37 (Alternate Detour 2). Close Atlantic Blvd on-ramps.																										

**Chart No. 35  
Complete Freeway Closure Hours**

County: LA	Route/Direction: 710/SB																									
Closure Limits: Firestone Blvd Off-ramp to Imperial Hwy On-ramp																										
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Mondays through Thursdays	C	C	C	C																						
Fridays		C	C	C																						
Saturdays																										
Sundays				C	C	C																				

Legend:

C Freeway may be closed completely

No complete freeway closure is permitted

**REMARKS:**

Detour traffic to exit at Firestone Blvd off-ramp; west on Firestone Blvd; south on Atlantic Ave; east on Imperial Hwy to the on-ramp to SB Route 710. Place a portable changeable message sign on the right shoulder of SB Route 710 south of Walker UP/Std Oil OC with the message: "FREEWAY/CLOSED/AHEAD – FIRESTONE/TO/IMPERIAL". A minimum of 12 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.  
Close Firestone Blvd on-ramps.

**Chart No. 36  
Complete Connector Closure Hours**

County: LA	Route/Direction: 5/NB																								
Closure Limits: NB Route 5 to NB Route 710																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C
Fridays	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C
Saturdays	C	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	C	C	C	C
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	C	C	C	C

Legend:

C
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 Connector may be closed completely

S
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 Shoulder closure permitted

**REMARKS:**

Alternate Detour 1:

Detour traffic to exit at Eastern Ave off-ramp; west on Telegraph Rd; north on Eastern Ave; east on Olympic Blvd to the on-ramp to NB Route 710. Place a portable changeable message sign on the right shoulder of NB Route 5 at the gore of Atlantic Blvd (North) off-ramp with the message: "N710/EXIT/CLOSED – DETOUR/USE/EASTERN". A minimum of 9 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

Alternate Detour 2:

Detour traffic to exit at Eastern Ave off-ramp; west on Telegraph Rd; north on Eastern Ave; direct NB Route 710 traffic east on 3rd St, south on Ford Blvd to the on-ramp to NB Route 710, and direct Route 60 traffic west on 3rd St to the on-ramps to Route 60. Place a portable changeable message sign on the right shoulder of NB Route 5 at the gore of Atlantic Blvd (North) off-ramp with the message: "N710/EXIT/CLOSED - DETOUR/USE/EASTERN". A minimum of 8 additional special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

**Chart No. 37  
Connector Lane Requirements and Hours of Work**

County: LA	Route/Direction: 5/SB																								
Closure Limits: SB Route 5 to SB Route 710																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	1	S	S	S	2	2	2	2	2	2	S	S	S	S	2	2	2	2	C	
Fridays	C	C	C	C	C	1	S	S	S	2	2	2	2	2	2	S	S	S	S	2	2	2	2	1	
Saturdays	C	C	C	C	C	C	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Sundays	1	C	C	C	C	C	C	C	C	1	1	2	2	2	2	2	2	2	2	2	2	2	1	C	

Legend:

- |   |
|---|
| 1 |
|---|

 Provide at least one connector lane open in direction of travel
- |   |
|---|
| 2 |
|---|

 Provide at least two adjacent connector lanes open in direction of travel
- |   |
|---|
| C |
|---|

 Connector may be closed completely
- |   |
|---|
| S |
|---|

 Shoulder closure permitted

REMARKS:

Alternate Detour 1:

Detour traffic to continue south on SB Route 5 and exit at Atlantic Blvd/Eastern Ave off-ramp; south on Eastern Ave; west on Washington Blvd to the on-ramp to SB Route 710. Place a portable changeable message sign inside the connector closure with the message: "S710/EXIT/CLOSED - DETOUR/USE/ATLANTIC". A minimum of 11 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

Alternate Detour 2:

Detour traffic to continue south on SB Route 5 and exit at Atlantic Blvd/Eastern Ave off-ramp; south on Eastern Ave; west on Washington Blvd; south on Atlantic Blvd; east on Florence Ave to the on-ramp to SB Route 710. Place a portable changeable message sign inside of the connector closure with the message: "S710/EXIT/CLOSED - DETOUR/USE/ATLANTIC". A minimum of 29 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

Alternate Detour 3:

Detour traffic to continue south on SB Route 5 and exit at Atlantic Blvd/Eastern Ave off-ramp; south on Eastern Ave; west on Washington Blvd; south on Atlantic Blvd to the on-ramp to SB Route 710. Place a portable changeable message sign inside of the connector closure with the message: "S710/EXIT/CLOSED - DETOUR/USE/ATLANTIC". A minimum of 13 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

**Chart No. 38  
Connector Lane Requirements and Hours of Work**

County: LA	Route/Direction: 710/NB																								
Closure Limits: NB Route 710 to NB Route 5																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	1	1	1	C	C
Fridays	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	1	C
Saturdays	C	C	C	C	C	C	1	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	1
Sundays	C	C	C	C	C	C	C	C	1	S	S	S	S	S	S	S	S	S	S	S	S	S	1	C	C

Legend:

- |   |
|---|
| 1 |
|---|

 Provide at least one connector lane open in direction of travel
  
- |   |
|---|
| C |
|---|

 Connector may be closed completely
  
- |   |
|---|
| S |
|---|

 Shoulder closure permitted

**REMARKS:**  
 Detour traffic to continue on NB Route 710 to WB Route 60. Place a portable changeable message sign on the right shoulder of NB Route 710 in advance of the NB Route 5 connector with the message: "NORTH 5/EXIT/CLOSED – USE/N 710 TO/WEST 60".

**Chart No. 39  
Complete Connector Closure Hours**

County: LA	Route/Direction: 710/SB	
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Closure Limits: SB Route 710 to SB Route 5

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C
Fridays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C
Saturdays	C	C	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	C	C	C	C	C	C	C
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C

Legend:

- C Connector may be closed completely
- S Shoulder closure permitted

**REMARKS:**  
 Alternate Detour 1:  
 Detour traffic to continue south on Route 710 and exit at Washington Blvd off-ramp; east on Washington Blvd to the on-ramp to SB Route 5. Place a portable changeable message sign inside the connector closure with the message: "SOUTH 5/EXIT/CLOSED – DETOUR/USE/WASHNGTN". A minimum of 12 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

Alternate Detour 2:  
 Detour traffic to exit at Olympic Blvd/Whittier Blvd off-ramp; south on Eastern Ave; east on Telegraph Rd; south on Triggs St to the on-ramp to SB Route 5. Place a portable changeable message sign at the gore of 3rd St on-ramp with the message: "SOUTH 5/EXIT/CLOSED – DETOUR/USE/OLYMPIC". A minimum of 12 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.

**Chart No. 40  
Complete Connector Closure Hours**

County: LA	Route/Direction: 60/EB																								
Closure Limits: EB Route 60 to NB Route 710																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C
Fridays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C
Saturdays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C

Legend:

**C** Connector may be closed completely

**S** Shoulder closure permitted

**REMARKS:**

**Alternate Detour 1:**

Detour traffic to exit at Downey Rd off-ramp; north on Downey Rd; east on 3rd St; south on Ford Blvd to the on-ramp to NB Route 710. Place a portable changeable message sign on the right shoulder of EB Route 60 in the gore area of Indiana St on-ramp with the message: "N 710/EXIT/CLOSED – DETOUR/USE/DOWNEY". A minimum of 12 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

**Alternate Detour 2:**

Detour traffic to exit at Downey Rd off-ramp; north on Downey Rd; east on 3rd St; north on Ford Blvd to the on ramp to NB Route 710. Place a portable changeable message sign on the right shoulder of EB Route 60 in the gore area of Indiana Street on-ramp with the message: "N 710/EXIT/CLOSED – DETOUR/USE/DOWNEY". A minimum of 12 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

**Alternate Detour 3:**

Detour traffic to exit at Downey Rd off-ramp; north on Downey Rd; east on 3rd St; north on Eastern Ave to the on-ramp to NB Route 710 and Route 10. Place a portable changeable message sign on the right shoulder of EB Route 60 in the gore area of Indiana Street on-ramp with the message: "N 710/EXIT/CLOSED – DETOUR/USE/DOWNEY". A minimum of 7 additional special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.

**Chart No. 41  
Complete Connector Closure Hours**

County: LA	Route/Direction: 60/EB																								
Closure Limits: EB Route 60 to SB Route 710																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C
Fridays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C
Saturdays	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C

Legend:

C Connector may be closed completely

S Shoulder closure permitted

**REMARKS:**

Detour traffic to exit at Downey Rd off-ramp; north on Downey Rd; east on 3rd St; south on Eastern Ave to the on-ramp to SB Route 710. Place a portable changeable message sign on the right shoulder of EB Route 60 in the gore area of Indiana St on-ramp with the message: "S710/EXIT/CLOSED – DETOUR/USE/DOWNEY". A minimum of 11 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.

**Chart No. 42**  
**Complete Connector Closure Hours**

County: LA	Route/Direction: 60/WB	
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Closure Limits: WB Route 60 to NB Route 710

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	
Fridays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	
Saturdays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	

Legend:

C Connector may be closed completely

S Shoulder closure permitted

**REMARKS:**

**Alternate Detour 1:**  
Detour traffic to continue on WB Route 60 and exit at Downey Rd off-ramp; east on 3rd St; south on Ford Blvd to the on-ramp to NB Route 710. Place a portable changeable message sign on the right shoulder of WB Route 60 between the Atlantic Blvd on- and off-ramps with the message: "N710/EXIT/CLOSED - DETOUR/USE/DOWNEY". A minimum of 9 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

**Alternate Detour 2:**  
Detour traffic to continue on WB Route 60 and exit at Downey Rd off-ramp; east on 3rd St; north on Ford Blvd to the on-ramp to NB Route 710. Place a portable changeable message sign on the right shoulder of WB Route 60 between the Atlantic Blvd on- and off-ramps with the message: "N710/EXIT/CLOSED - DETOUR/USE/DOWNEY". A minimum of 12 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

**Alternate Detour 3:**  
Detour traffic to continue on WB Route 60 and exit at Downey Rd off-ramp; east on 3rd St; north on Eastern Ave to the on-ramps to NB Route 710 and Route 10. Place a portable changeable message sign on the right shoulder of WB Route 60 approximately 300 ft east of Belvedere Park POC with the message: "N710/EXIT/ CLOSED - DETOUR/USE/DOWNEY". A minimum of 10 additional special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.  
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.

**Chart No. 43  
Complete Connector Closure Hours**

County: LA	Route/Direction: 60/WB																								
Closure Limits: WB Route 60 to SB Route 710																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C
Fridays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C
Saturdays	C	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	C	C	C	C	C	C
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C

Legend:

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 Connector may be closed completely

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 Shoulder closure permitted

**REMARKS:**

Detour traffic to continue on WB Route 60 and exit at Downey Rd off-ramp; east on 3rd St; south on Eastern Ave to the on-ramp to SB Route 710. Place a portable changeable message sign on the right shoulder of WB Route 60 just west of the SB Atlantic Ave on-ramp with the message: "S 710/EXIT/CLOSED – DETOUR/ USE/DOWNEY". A minimum of 10 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.

**Chart No. 44  
Complete Connector Closure Hours**

County: LA	Route/Direction: 710/NB																								
Closure Limits: NB Route 710 to Route 60																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C
Fridays	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C
Saturdays	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Sundays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C

Legend:

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 Shoulder closure permitted

**REMARKS:**  
 Alternate Detour 1:  
 Detour traffic to exit at Olympic Blvd off-ramp; west on Olympic Blvd; north on Eastern Ave; west on 3rd St to the on-ramps to Route 60. Place a portable changeable message sign on the right shoulder of NB Route 710 north of the East Yard OH with the message: "RTE 60/EXITS/CLOSED - DETOUR/USE/OLYMPIC". A minimum of 14 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure. Place a second portable changeable message sign on the right shoulder of NB Route 710 by the Olympic Blvd on-ramp gore with the message: "RTE 60/EXITS/CLOSED - DETOUR/USE/C CHAVEZ". Detour Cesar Chavez Ave off-ramp traffic to go south on Ford Blvd; west on 3rd St to the on-ramps to Route 60. A minimum of 9 additional special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.  
 Alternate Detour 2:  
 Detour traffic to continue north on Route 710 and exit at 3rd St off-ramp; north on Ford Blvd; west on 3rd St to the on-ramps to Route 60. Place a portable changeable message sign inside the closure by the Olympic Blvd on-ramp gore with the message: "RTE 60/EXITS/CLOSED - DETOUR/USE/C CHAVEZ". A minimum of 9 additional special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

**Chart No. 45  
Complete Connector Closure Hours**

County: LA	Route/Direction: 710/SB																								
Closure Limits: SB Route 710 to Route 60																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	C
Fridays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	C
Saturdays	C	C	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	C	C	C	C	C	C	C
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C

Legend:

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 Shoulder closure permitted

**REMARKS:**

**Alternate Detour 1:**

Detour traffic to continue south on Route 710 and exit at Olympic Blvd/Whittier Blvd off-ramp; south on Eastern Ave; east on Olympic Blvd to the on-ramp to NB Route 710. Place a portable changeable message sign on the right shoulder of SB Route 710 in advance of the Floral Dr / Cesar Chavez Ave off-ramp with the message: "RTE 60/EXITS/CLOSED – DETOUR/USE/OLYMPIC". A minimum of 7 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

**Alternate Detour 2:**

Detour traffic to exit at Floral Dr / Cesar Chavez Ave off-ramp; east on Floral Dr to the on-ramp to Route 60. Place a portable changeable message sign on the right shoulder of SB Route 710 just south of Ramona Blvd on-ramp with the message: "RTE 60/EXITS/CLOSED – DETOUR/USE/C CHAVEZ". A minimum of 11 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

**Alternate Detour 3:**

Detour traffic to continue south on Route 710 and exit at Olympic Blvd/Whittier Blvd off-ramp; north on Eastern Ave; west on 3rd St to the on-ramps to Route 60. Place a portable changeable message sign on the right shoulder of SB Route 710 in advance of the Floral Dr / Cesar Chavez Ave off-ramp with the message: "RTE 60/EXITS/CLOSED – DETOUR/USE/OLYMPIC". A minimum of 10 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure. The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.

**Chart No. 46  
Complete Connector Closure Hours**

County: LA	Route/Direction: 10/EB																								
Closure Limits: EB Route 10 to SB Route 710																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	
Fridays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	
Saturdays	C	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	C	C	C	C	C	C	C		
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C		

Legend:

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 Connector may be closed completely
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 Shoulder closure permitted

**REMARKS:**  
 Alternate Detour 1:  
 Detour traffic to exit at Eastern Ave off-ramp; south on Eastern Ave; east on Cesar Chavez Ave to the on-ramp to SB Route 710. Place a portable changeable message sign on the right shoulder of EB Route 10 in the gore area of the City Terrace Dr off-ramp with the message: "S710/EXIT/CLOSED – DETOUR/USE/EASTERN". A minimum of 9 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

Alternate Detour 2:  
 Detour traffic to go north on Route 710 and exit at Valley Blvd; west on Valley Blvd to the on-ramp to SB Route 710. Place a portable changeable message sign inside the connector closure with the message: "S710/EXIT/CLOSED – DETOUR/USE/N710". A minimum of 5 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

Alternate Detour 3:  
 Detour traffic to exit at Eastern Ave off-ramp; south on Eastern Ave; direct SB Route 710 traffic to continue south on Eastern Ave to the on-ramp to SB Route 710 and direct Route 60 traffic west on 3rd St to the on-ramps to Route 60. Place a portable changeable message sign on the right shoulder of EB Route 10 in the gore area of the City Terrace Dr off-ramp with the message: "S710/EXIT/CLOSED – DETOUR/USE/EASTERN". A minimum of 10 additional special freeway detour signs (SP-2), as shown on plans, and 2 SP-6 on SB Eastern Ave in advance of 3rd St, shall be posted along the detour route and shall be removed at the end of each closure.  
 The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.

**Chart No. 47  
Complete Connector Closure Hours**

County: LA	Route/Direction: 10/WB																								
Closure Limits: WB Route 10 to SB Route 710																									
FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C
Fridays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C
Saturdays	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	C	C	C	C	C	C	C	
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	

Legend:

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 Connector may be closed completely
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 Shoulder closure permitted

**REMARKS:**

Alternate Detour 1:  
 Detour traffic to exit at Eastern Ave off-ramp; south on Campus Rd; east on Ramona Blvd to the on-ramp to SB Route 710. Place a portable changeable message sign on the right shoulder of WB Route 10 in advance of the connector with the message: "S710/EXIT/CLOSED - DETOUR/USE/EASTERN". A minimum of 7 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

Alternate Detour 2:  
 Detour traffic to exit at Eastern Ave off-ramp and continue west on University Dr; south on Eastern Ave; east on Cesar Chavez Ave to the on-ramp to SB Route 710. Place a portable changeable message sign on the right shoulder of WB Route 10 in advance of the connector with the message: "S710/EXIT/CLOSED – DETOUR/ USE/EASTERN". A minimum of 12 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

Alternate Detour 3:  
 Detour traffic onto NB Route 710 and exit at Valley Blvd off-ramp; west on Valley Blvd to the on-ramp to SB Route 710. Place a portable changeable message sign on the right shoulder of WB Route 10 approximately 400 feet east of Warwick Rd POC with the message: "S710/EXIT/CLOSED – DETOUR/USE/N710". A minimum of 7 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

Alternate Detour 4:  
 Detour traffic to exit at Eastern Ave off-ramp and continue west on University Dr; south on Eastern Ave; direct SB Route 710 traffic to continue south on Eastern Ave to the on-ramp to SB Route 710 and direct Route 60 traffic west on 3rd St to the on-ramps Route 60. Place a portable changeable message sign on the right shoulder of WB Route 10 in advance of the connector with the message: "S710/EXIT/CLOSED – DETOUR/ USE/EASTERN". A minimum of 6 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.

The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.

<b>Chart No. 48</b>																													
<b>Complete Connector Closure Hours</b>																													
County: LA										Route/Direction: 710/NB																			
Closure Limits: NB Route 710 to Route 10																													
FROM HOUR TO HOUR																													
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Mondays through Thursdays	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C			
Fridays	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S			
Saturdays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S			
Sundays	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C			
Legend:																													
<table border="0"> <tr> <td style="border: 1px solid black; padding: 2px;">C</td> <td>Connector may be closed completely</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">S</td> <td>Shoulder closure permitted</td> </tr> </table>																										C	Connector may be closed completely	S	Shoulder closure permitted
C	Connector may be closed completely																												
S	Shoulder closure permitted																												
REMARKS:																													
Detour traffic to continue on NB Route 710 to the end of the freeway at Valley Blvd; west on Valley Blvd to the on-ramp to SB Route 710. Place a portable changeable message sign on the right shoulder of NB Route 710 in advance of the Ramona Blvd off-ramp and south of the 2-post overhead sign structure with the message: "ROUTE 10/EXITS/CLOSED – DETOUR/USE/VALLEY". A minimum of 3 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																													

<b>Chart No. 49</b>																													
<b>Complete Ramp Closure Hours</b>																													
County: LA										Route/Direction: 710/NB																			
Closure Limits: Off-ramp to Firestone Blvd																													
FROM HOUR TO HOUR																													
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
Mondays through Thursdays	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S			
Fridays	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S			
Saturdays	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S			
Sundays	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C			
Legend:																													
<table border="0"> <tr> <td style="border: 1px solid black; padding: 2px;">C</td> <td>Ramp may be closed completely</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">S</td> <td>Shoulder closure permitted</td> </tr> </table>																										C	Ramp may be closed completely	S	Shoulder closure permitted
C	Ramp may be closed completely																												
S	Shoulder closure permitted																												
REMARKS:																													

Chart No. 50 Complete Ramp Closure Hours																										
County: LA					Route/Direction: 710/NB																					
Closure Limits: On-ramp from EB Firestone Blvd																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	
Fridays		C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	
Saturdays		C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	
Sundays		C	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	C	C	C	C	
Legend:																										
C		Ramp may be closed completely																								
S		Shoulder closure permitted																								
REMARKS:																										
Detour traffic to continue east on Firestone Blvd; north on Garfield Ave; west on Florence Ave to the on-ramp to NB Route 710. A minimum of 16 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																										

Chart No. 51 Complete Ramp Closure Hours																										
County: LA					Route/Direction: 710/NB																					
Closure Limits: On-ramp from WB Firestone Blvd																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	
Fridays		C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	
Saturdays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Sundays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Legend:																										
C		Ramp may be closed completely																								
S		Shoulder closure permitted																								
REMARKS:																										
Detour traffic to continue west on Firestone Blvd; north on Atlantic Ave; east on Florence Ave to the on-ramp to NB Route 710. A minimum of 17 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure. The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																										

Chart No. 52 Complete Ramp Closure Hours																																	
County: LA										Route/Direction: 710/SB																							
Closure Limits: Off-ramp to Firestone Blvd																																	
FROM HOUR TO HOUR 24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24																																	
Mondays through Thursdays										C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	
Fridays										C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Saturdays										C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Sundays										C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C
Legend:																																	
C Ramp may be closed completely																																	
S Shoulder closure permitted																																	
REMARKS:																																	

Chart No. 53 Complete Ramp Closure Hours																																		
County: LA										Route/Direction: 710/SB																								
Closure Limits: On-ramp from WB Firestone Blvd																																		
FROM HOUR TO HOUR 24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24																																		
Mondays through Thursdays										C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C
Fridays										C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C
Saturdays										C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C
Sundays										C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C
Legend:																																		
C Ramp may be closed completely																																		
S Shoulder closure permitted																																		
REMARKS: Detour traffic to continue west on Firestone Blvd; south on Atlantic Ave; east on Imperial Hwy to the on-ramp to SB Route 710. A minimum of 12 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																																		

Chart No. 54 Complete Ramp Closure Hours																										
County: LA					Route/Direction: 710/SB																					
Closure Limits: On-ramp from EB Firestone Blvd																										
FROM HOUR TO HOUR 24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24																										
Mondays through Thursdays					C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C
Fridays					C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C
Saturdays					C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C
Sundays					C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	C	C	C	C	C	C	C
Legend:																										
C Ramp may be closed completely																										
S Shoulder closure permitted																										
REMARKS:																										
Detour traffic to continue east on Firestone Blvd; south on Garfield Ave; west on Imperial Hwy to the on-ramp to SB Route 710. A minimum of 10 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																										

Chart No. 55 Complete Ramp Closure Hours																										
County: LA					Route/Direction: 710/NB																					
Closure Limits: Off-ramp to EB Florence Ave																										
FROM HOUR TO HOUR 24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24																										
Mondays through Thursdays					C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C
Fridays					C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C
Saturdays					C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	C	C	C
Sundays					C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	C	C	C	C
Legend:																										
C Ramp may be closed completely																										
S Shoulder closure permitted																										
REMARKS:																										

<b>Chart No. 56</b>																																		
<b>Complete Ramp Closure Hours</b>																																		
County: LA										Route/Direction: 710/NB																								
Closure Limits: Off-ramp to WB Florence Ave																																		
FROM HOUR TO HOUR 24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24																																		
Mondays through Thursdays										C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C		
Fridays										C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	
Saturdays										C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C
Sundays										C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C
Legend:																																		
C Ramp may be closed completely																																		
S Shoulder closure permitted																																		
REMARKS:																																		

<b>Chart No. 57</b>																																	
<b>Complete Ramp Closure Hours</b>																																	
County: LA										Route/Direction: 710/NB																							
Closure Limits: On-ramp from EB Florence Ave																																	
FROM HOUR TO HOUR 24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24																																	
Mondays through Thursdays										C	C	C	C	C	S	S	S	S	C	C	C	C	C	S	S	S	S	S	C	C	C	C	C
Fridays										C	C	C	C	C	S	S	S	S	C	C	C	C	C	S	S	S	S	S	S	S	C	C	C
Saturdays										C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C
Sundays										C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	C	C	C
Legend:																																	
C Ramp may be closed completely																																	
S Shoulder closure permitted																																	
REMARKS: Detour traffic to continue east on Florence Ave; north on Garfield Ave; east on Telegraph Rd to the on-ramp to NB Route 5. A minimum of 17 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																																	

<b>Chart No. 58</b>																									
<b>Complete Ramp Closure Hours</b>																									
County: LA										Route/Direction: 710/NB															
Closure Limits: On-ramp from WB Florence Ave																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C
Fridays	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	
Saturdays	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C
Sundays	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	C	C	
Legend:																									
C Ramp may be closed completely																									
S Shoulder closure permitted																									
REMARKS:																									
Detour traffic to continue west on Florence Ave; north on Atlantic Ave to the on-ramp to NB Route 710. A minimum of 17 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																									

<b>Chart No. 59</b>																									
<b>Complete Ramp Closure Hours</b>																									
County: LA										Route/Direction: 710/SB															
Closure Limits: Off-ramp to WB Florence Ave																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	
Fridays	C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	
Saturdays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Legend:																									
C Ramp may be closed completely																									
S Shoulder closure permitted																									
REMARKS:																									
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																									

<b>Chart No. 60</b>																										
<b>Complete Ramp Closure Hours</b>																										
County: LA						Route/Direction: 710/SB																				
Closure Limits: Off-ramp to EB Florence Ave																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	
Fridays		C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	
Saturdays		C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	
Sundays		C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	
Legend:																										
<input type="checkbox"/> C		Ramp may be closed completely																								
<input type="checkbox"/> S		Shoulder closure permitted																								
REMARKS:																										

<b>Chart No. 61</b>																										
<b>Complete Ramp Closure Hours</b>																										
County: LA						Route/Direction: 710/SB																				
Closure Limits: Off-ramp to Florence Ave																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	
Fridays		C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	
Saturdays		C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	
Sundays		S	S	S	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	
Legend:																										
<input type="checkbox"/> C		Ramp may be closed completely																								
<input type="checkbox"/> S		Shoulder closure permitted																								
REMARKS:																										

<b>Chart No. 62</b>																										
<b>Complete Ramp Closure Hours</b>																										
County: LA						Route/Direction: 710/SB																				
Closure Limits: On-ramp from WB Florence Ave																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	
Fridays		C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	
Saturdays		C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	
Sundays		C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	
Legend:																										
C		Ramp may be closed completely																								
S		Shoulder closure permitted																								
REMARKS:																										
Detour traffic to continue west on Florence Ave; south on Atlantic Ave; east on Firestone Blvd to the on-ramp to SB Route 710. A minimum of 16 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																										

<b>Chart No. 63</b>																										
<b>Complete Ramp Closure Hours</b>																										
County: LA						Route/Direction: 710/SB																				
Closure Limits: On-ramp from EB Florence Ave																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C		
Fridays		C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C		
Saturdays		C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S		
Sundays		C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C		
Legend:																										
C		Ramp may be closed completely																								
S		Shoulder closure permitted																								
REMARKS:																										
Detour traffic to continue east on Florence Ave; south on Garfield Ave; west on Firestone Blvd to the on-ramp to SB Route 710. A minimum of 19 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																										

<b>Chart No. 64</b>																									
<b>Complete Ramp Closure Hours</b>																									
County: LA					Route/Direction: 710/NB																				
Closure Limits: Off-ramp to NB Atlantic Blvd/EB Bandini Blvd																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Fridays	C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Saturdays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																									
C Ramp may be closed completely																									
S Shoulder closure permitted																									
REMARKS:																									
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																									

<b>Chart No. 65</b>																									
<b>Complete Ramp Closure Hours</b>																									
County: LA					Route/Direction: 710/NB																				
Closure Limits: Off-ramp to SB Atlantic Blvd/WB Bandini Blvd																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	C
Fridays	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	C
Saturdays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																									
C Ramp may be closed completely																									
S Shoulder closure permitted																									
REMARKS:																									
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																									

Chart No. 66 Complete Ramp Closure Hours																									
County: LA					Route/Direction: 710/SB																				
Closure Limits: Off-ramp to Atlantic Blvd/Bandini Blvd																									
FROM HOUR TO HOUR 24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24																									
Mondays through Thursdays					C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C
Fridays					C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Saturdays					C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Sundays					C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	C
Legend:																									
C Ramp may be closed completely																									
S Shoulder closure permitted																									
REMARKS:																									

Chart No. 67 Complete Ramp Closure Hours																											
County: LA					Route/Direction: 710/SB																						
Closure Limits: On-ramp from SB Atlantic Blvd																											
FROM HOUR TO HOUR 24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24																											
Mondays through Thursdays					C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C
Fridays					C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C
Saturdays					C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays					C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																											
C Ramp may be closed completely																											
S Shoulder closure permitted																											
REMARKS: Detour traffic to continue south on Atlantic Blvd; east on Florence Ave to the on-ramp to SB Route 710. A minimum of 18 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure. The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																											

<b>Chart No. 68</b>																										
<b>Complete Ramp Closure Hours</b>																										
County: LA					Route/Direction: 710/SB																					
Closure Limits: On-ramp from NB Atlantic Blvd																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	S	S	S	S	S	C	C	C	C	C	C
Fridays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	S	S	S	S	S	C	C	C	C	C	C
Saturdays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																										
C		Ramp may be closed completely																								
S		Shoulder work permitted																								
REMARKS:																										
Detour traffic to continue north on Atlantic Blvd; east on Bandini Blvd; south on Garfield Ave; west on Florence Ave to the on-ramp to SB Route 710. A minimum of 22 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure. The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																										

<b>Chart No. 69</b>																										
<b>Complete Ramp Closure Hours</b>																										
County: LA					Route/Direction: 710/NB																					
Closure Limits: Off-ramp to Olympic Blvd																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C
Fridays		C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C
Saturdays		C	C	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	C	C	C	C	C
Sundays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																										
C		Ramp may be closed completely																								
S		Shoulder closure permitted																								
REMARKS:																										
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																										

Chart No. 70 Complete Ramp Closure Hours																										
County: LA					Route/Direction: 710/NB																					
Closure Limits: On-ramp from Olympic Blvd																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	C
Fridays		C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	C
Saturdays		C	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	C	C	C	C	C	C
Sundays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																										
C		Ramp may be closed completely																								
S		Shoulder closure permitted																								
REMARKS:																										
Detour EB traffic to go north on Arizona Ave; west on 3rd St; south on Ford Blvd to the on-ramp to NB Route 710. A minimum of 14 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																										
Detour WB traffic to continue on Olympic Blvd; north on Eastern Ave; east on 3rd St; south on Ford Blvd to the on-ramp to NB Route 710. A minimum of 11 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																										
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																										

Chart No. 71 Complete Ramp Closure Hours																										
County: LA					Route/Direction: 710/SB																					
Closure Limits: Off-ramp to Olympic Blvd/Whittier Blvd																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	C
Fridays		C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	C
Saturdays		C	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	C	C	C	C	C	C	C
Sundays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																										
C		Ramp may be closed completely																								
S		Shoulder closure permitted																								
REMARKS:																										
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																										

Chart No. 72																										
Complete Ramp Closure Hours																										
County: LA										Route/Direction: 710/SB																
Closure Limits: On-ramp from Olympic Blvd/Eastern Ave																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	S	S	S	S	S	C	C	C	C	C	
Fridays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	S	S	S	S	S	C	C	C	C	C	
Saturdays		C	C	C	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	C	C	C	C	C	C	
Sundays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Legend:																										
C		Ramp may be closed completely																								
S		Shoulder closure permitted																								
REMARKS:																										
Detour NB traffic to continue north on Eastern Ave; east on Cesar Chavez Ave to the on-ramp to SB Route 710. A minimum of 7 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																										
Detour SB traffic to continue south on Eastern Ave; west on Olympic Blvd; north on Ditman Ave to the on-ramp to SB Route 5 to SB Route 710. A minimum of 9 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																										
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																										

Chart No. 73																										
Complete Ramp Closure Hours																										
County: LA										Route/Direction: 710/NB																
Closure Limits: Off-ramp to 3rd St																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	
Fridays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	
Saturdays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Sundays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Legend:																										
C		Ramp may be closed completely																								
S		Shoulder closure permitted																								
REMARKS:																										
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																										

Chart No. 74																										
Complete Ramp Closure Hours																										
County: LA							Route/Direction: 710/NB																			
Closure Limits: On-ramp from 3rd St																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Fridays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Saturdays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																										
C		Ramp may be closed completely																								
S		Shoulder closure permitted																								
REMARKS:																										
Detour 3rd St and Ford Blvd traffic to go north on Ford Blvd to the on-ramp to NB Route 710. A minimum of 6 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																										
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																										

Chart No. 75																										
Complete Ramp Closure Hours																										
County: LA							Route/Direction: 710/SB																			
Closure Limits: On-ramp from 3rd St																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Fridays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Saturdays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																										
C		Ramp may be closed completely																								
S		Shoulder closure permitted																								
REMARKS:																										
Detour WB traffic to continue west on 3rd St; north on Eastern Ave; east on Cesar Chavez Ave to the on-ramp to SB Route 710. A minimum of 5 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																										
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																										

<b>Chart No. 76</b>																										
<b>Complete Ramp Closure Hours</b>																										
County: LA							Route/Direction: 710/SB																			
Closure Limits: Off-ramp to 3rd St																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Fridays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Saturdays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																										
C		Ramp may be closed completely																								
S		Shoulder closure permitted																								
REMARKS:																										
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																										

<b>Chart No. 77</b>																										
<b>Complete Ramp Closure Hours</b>																										
County: LA							Route/Direction: 710/NB																			
Closure Limits: Off-ramp to Cesar Chavez Ave																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Fridays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Saturdays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																										
C		Ramp may be closed completely																								
S		Shoulder closure permitted																								
REMARKS:																										
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																										

Chart No. 78 Complete Ramp Closure Hours																									
County: LA										Route/Direction: 710/SB															
Closure Limits: On-ramp from Cesar Chavez Ave																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	C	S	S	S	C	C	C	C	S	S	S	S	S	S	C	C	C	C	C	C
Fridays	C	C	C	C	C	C	S	S	S	C	C	C	C	S	S	S	S	S	S	C	C	C	C	C	C
Saturdays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																									
C Ramp may be closed completely																									
S Shoulder closure permitted																									
REMARKS:																									
Detour EB traffic to continue east on Cesar Chavez Ave; south on Ford Blvd; west on 3rd St to the on-ramp to SB Route 710. A minimum of 6 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																									
Detour WB traffic to continue west on Cesar Chavez Ave; south on Eastern Ave to the on-ramp to SB Route 710. A minimum of 7 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																									
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																									

Chart No. 79 Complete Ramp Closure Hours																									
County: LA										Route/Direction: 710/NB															
Closure Limits: On-ramp from Floral Dr																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Fridays	C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Saturdays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																									
C Ramp may be closed completely																									
S Shoulder closure permitted																									
REMARKS:																									
Detour Floral Dr traffic to go south on Ford Blvd to the on-ramp to NB Route 710. Detour NB Ford Blvd traffic to go east on Floral Dr; south on McDonnell Ave; west on Fisher St; south on Ford Blvd to the on-ramp to NB Route 710. A minimum of 17 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																									
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																									

<b>Chart No. 80</b>																										
<b>Complete Ramp Closure Hours</b>																										
County: LA							Route/Direction: 710/SB																			
Closure Limits: Off-ramp to Floral Dr/Cesar Chavez Ave																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Fridays		C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Saturdays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																										
<input type="checkbox"/> C		Ramp may be closed completely																								
<input type="checkbox"/> S		Shoulder closure permitted																								
REMARKS:																										
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																										

<b>Chart No. 81</b>																										
<b>Complete Ramp Closure Hours</b>																										
County: LA							Route/Direction: 710/NB																			
Closure Limits: Off-ramp to Ramona Blvd																										
FROM HOUR TO HOUR		24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays		C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Fridays		C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Saturdays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																										
<input type="checkbox"/> C		Ramp may be closed completely																								
<input type="checkbox"/> S		Shoulder closure permitted																								
REMARKS:																										
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																										

Chart No. 82 Complete Ramp Closure Hours																									
County: LA										Route/Direction: 710/SB															
Closure Limits: On-ramp from Ramona Blvd																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Fridays	C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Saturdays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																									
C Ramp may be closed completely																									
S Shoulder closure permitted																									
REMARKS:																									
Detour EB traffic to continue east on Ramona Blvd; south on Corporate Center Dr; west on Floral Dr; south on Ford Blvd; west on Cesar Chavez Ave to the on-ramp to SB Route 710. A minimum of 14 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																									
Detour WB traffic to continue west on Ramona Blvd; south on Eastern Ave; east on Cesar Chavez to the on-ramp to SB Route 710. A minimum of 10 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.																									
The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.																									

Chart No. 83 City Street Requirements and Hours of Work																									
Location: Atlantic Blvd										Direction: NB and SB															
Between Slauson Ave and Bandini Blvd																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	N	N	N	N	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	C
Fridays	C	C	C	C	C	N	N	N	N	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	C
Saturdays	C	C	C	C	C	N	N	N	1	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	C
Sundays	C	C	C	C	C	C	C	1	1	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	C
Legend:																									
1 Provide at least one city street lane open in each direction of travel																									
C Street may be closed																									
N No work permitted																									
REMARKS: When the street is closed detour traffic as shown in Motorist Information Plans.																									

Chart No. 84																									
City Street Requirements and Hours of Work																									
Location: Telegraph Rd										Direction: EB and WB															
Between Eastern Ave and Arizona Ave																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	N	N	N	N	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Fridays	C	C	C	C	C	N	N	N	N	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Saturdays	C	C	C	C	C	N	N	N	1	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Sundays	C	C	C	C	C	C	C	C	1	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Legend:																									
1	Provide at least one city street lane open in each direction of travel																								
C	Street may be closed																								
N	No work permitted																								
REMARKS: When the street is closed detour traffic as shown in Motorist Information Plans.																									

Chart No. 85																									
City Street Requirements and Hours of Work																									
Location: Olympic Blvd										Direction: EB and WB															
Between Eastern Ave and Arizona Ave																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	N	N	N	N	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Fridays	C	C	C	C	C	N	N	N	N	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Saturdays	C	C	C	C	C	N	N	N	1	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Sundays	C	C	C	C	C	C	C	C	1	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Legend:																									
1	Provide at least one city street lane open in each direction of travel																								
C	Street may be closed																								
N	No work permitted																								
REMARKS: When the street is closed detour traffic as shown in Motorist Information Plans.																									

Chart No. 86																									
City Street Requirements and Hours of Work																									
Location: Whittier Blvd										Direction: EB and WB															
Between Eastern Ave and Ford Blvd																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	N	N	N	N	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Fridays	C	C	C	C	C	N	N	N	N	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Saturdays	C	C	C	C	C	N	N	N	1	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Sundays	C	C	C	C	C	C	C	C	1	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Legend:																									
1	Provide at least one city street lane open in each direction of travel																								
C	Street may be closed																								
N	No work permitted																								
REMARKS: When the street is closed detour traffic as shown in Motorist Information Plans.																									

Chart No. 87																									
City Street Requirements and Hours of Work																									
Location: Floral Dr										Direction: EB and WB															
Between Humphreys Ave and Ford Blvd																									
FROM HOUR TO HOUR																									
	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	N	N	N	N	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Fridays	C	C	C	C	C	N	N	N	N	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Saturdays	C	C	C	C	C	N	N	N	1	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Sundays	C	C	C	C	C	C	C	C	1	1	1	1	1	1	1	N	N	N	N	1	1	C	C	C	
Legend:																									
1	Provide at least one city street lane open in each direction of travel																								
C	Street may be closed																								
N	No work permitted																								
REMARKS: When the street is closed detour traffic as shown in Motorist Information Plans.																									

TABLE 1

Permissible Hours of Lane Closures for  
Concrete Slab Replacement

Location: NB Route 710; Atlantic Blvd UC to Bandini Blvd UC

Slab No. Being Replaced	Lane No. Closed	Remove, Replace, and Cure Slabs
		Closure Hours
3	1, 2, 3 & 4	0001 Saturday to 0700 Saturday 0100 Sunday to 0900 Sunday
4 or 4 & 5	3, 4 & 5	0001 Saturday to 0600 Saturday 0100 Sunday to 0700 Sunday
5	4 & 5	2300 Friday to 0900 Saturday 2300 Saturday to 1100 Sunday
Slab No. Being Replaced	Other Closure Requirements	
3	Open Lane No. 4 by 0500 hours on Saturday and by 0600 hours on Sunday.	
4 or 4 & 5	Place a portable changeable message sign as shown on the Traffic Handling Details Plan.	
5	Open Lane No. 4 by 0700 hours on Saturday and by 0900 hours on Sunday.	

TABLE 2

Permissible Hours of Lane Closures for  
Concrete Approach Slab Replacement

Location: NB Route 710; At Route 5/710 Sep

Slab No. Being Replaced	Lane No. Closed	Remove, Replace, and Cure Slabs
		Closure Hours
1	1 & 2	0001 Saturday to 0800 Saturday 0001 Sunday to 1000 Sunday
2	1, 2 & 3	0001 Sunday to 0900 Sunday
3	2 & 3	0001 Saturday to 0900 Saturday 0001 Sunday to 1000 Sunday
Slab No. Being Replaced	Other Closure Requirements	
1	Open Lane No. 2 by 0600 hours on Saturday and by 0800 hours on Sunday. Provide a slip-ramp to NB Route 5 off-connector as shown on the Traffic Handling Details Plan - Option 2. Place a portable changeable message sign as shown on the Traffic Handling Details Plan.	
2	Close NB Route 710 at NB Route 5 off-connector. Detour traffic to exit at Washington Blvd off-ramp; east on Washington Blvd; north on Atlantic Blvd; east on Telegraph Rd to the on-ramp to NB Route 5 to NB Route 710. Place a portable changeable message sign on the right shoulder of NB Route 710 just north of Slauson Ave UP with the message: "FREEWAY/CLOSED/AHEAD - DETOUR/USE/WASHNGTN". A minimum of 14 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.	
3	Open Lane No. 2 by 0700 hours on Saturday and by 0800 hours on Sunday. Place a portable changeable message sign as shown on the Traffic Handling Details Plan.	

Note: Median or outside shoulder slabs may be reconstructed concurrently with the adjacent freeway slab.

TABLE 3		
Permissible Hours of Lane Closures for Concrete Slab Replacement		
Location: NB Route 710; Olympic Blvd Off-ramp to Olympic Blvd On-ramp		
Slab No. Being Replaced	Lane No. Closed	Remove, Replace, and Cure Slabs
		Closure Hours
3	2 & 3	2300 Friday to 0700 Saturday 2300 Saturday to 0900 Sunday
Slab No. Being Replaced	Other Closure Requirements	
3	Place a portable changeable message sign as shown on the Traffic Handling Details Plan.	

Note: Outside shoulder slabs may be reconstructed concurrently with the adjacent freeway slab.

TABLE 4

Permissible Hours of Lane Closures for  
Concrete Slab Replacement

Location: NB Route 710; Whittier Blvd Sep to 3rd St On-ramp		
Slab No. Being Replaced	Lane No. Closed	Remove, Replace, and Cure Slabs
		Closure Hours
3	2, 3, 4 & 5	2300 Friday to 0600 Saturday 0001 Sunday to 0700 Sunday
Slab No. Being Replaced	Other Closure Requirements	
3	Place a portable changeable message sign as shown on the Traffic Handling Details Plan. Close NB Route 5 to NB Route 710 connector and detour traffic as shown on Chart 36 (Alternate Detour 2). Close NB Route 710 to Route 60 connector and detour traffic as shown on Chart 44 (Alternate Detour 2). Close Olympic Blvd on-ramp.	

TABLE 5

Permissible Hours of Lane Closures for  
Concrete Slab Replacement

Location: NB Route 710; Whittier Blvd Sep to 3rd St On-ramp		
Slab No. Being Replaced	Lane No. Closed	Remove, Replace, and Cure Slabs
		Closure Hours
3	2, 3 & 4	2300 Friday to 0900 Saturday 2200 Saturday to 1100 Sunday
Slab No. Being Replaced	Other Closure Requirements	
3	Provide a slip-ramp to Route 60 off-connector. Close Olympic Blvd on-ramp.	

TABLE 6

Permissible Hours of Lane Closures for  
Concrete Slab Replacement

Location: NB Route 710; Floral Dr On-ramp to Ramona Blvd Off-ramp		
Slab No. Being Replaced	Lane No. Closed	Remove, Replace, and Cure Slabs
		Closure Hours
1	1 & 2	2300 Friday to 1000 Saturday 2300 Saturday to 1200 Sunday
2 or 1 & 2	1, 2 & 3	2300 Friday to 0800 Saturday 2300 Saturday to 1000 Sunday
Slab No. Being Replaced	Other Closure Requirements	
1	Open Lane No. 2 by 0800 hours on Saturday and by 1000 hours on Sunday. Place a portable changeable message sign as shown on the Traffic Handling Details Plan. Close Floral Dr on-ramp.	
2 or 1 & 2	Place a portable changeable message sign as shown on the Traffic Handling Details Plan. Use partial shoulder as a traffic lane as shown on Standard Plans. Close Floral Dr on-ramp.	

TABLE 7

Permissible Hours of Lane Closures for  
Concrete Slab Replacement

Location: SB Route 710; EB Route 10 On-connector to Floral Dr Off-ramp		
Slab No. Being Replaced	Lane No. Closed	Remove, Replace, and Cure Slabs
		Closure Hours
1	1 & 2	0001 Saturday to 0900 Saturday 0001 Sunday to 1200 Sunday
2 or 1 & 2	1, 2 & 3	0001 Saturday to 0700 Saturday 0001 Sunday to 1000 Sunday
Slab No. Being Replaced	Other Closure Requirements	
1	Open Lane No. 2 by 0700 hours on Saturday and by 1000 hours on Sunday. Place a portable changeable message sign as shown on the Traffic Handling Details Plan.	
2 or 1 & 2	Place a portable changeable message sign as shown on the Traffic Handling Details Plan. Use partial shoulder as a traffic lane as shown on Standard Plans.	

TABLE 8

Permissible Hours of Lane Closures for  
Concrete Slab Replacement

Location: SB Route 710; Olympic Blvd Off-ramp to Olympic Blvd On-ramp

Slab No. Being Replaced	Lane No. Closed	Remove, Replace, and Cure Slabs
		Closure Hours
2	1, 2 & 3	2300 Friday to 0700 Saturday 0100 Sunday to 0900 Sunday
4 or 4 & 5	3 & 4	0001 Saturday to 0600 Saturday 0100 Sunday to 0900 Sunday
5	3 & 4	0001 Saturday to 0800 Saturday 0001 Sunday to 1100 Sunday
Slab No. Being Replaced	Other Closure Requirements	
2	Place a portable changeable message sign as shown on the Traffic Handling Details Plan. Close SB Route 710 to SB Route 5 connector and detour traffic as shown on Chart 39 (Alternate Detour 1).	
4 or 4 & 5	Place a portable changeable message sign as shown on the Traffic Handling Details Plan. Close Olympic Blvd/Eastern Ave on-ramp.	
5	Open Lane No. 3 by 0600 hours on Saturday and by 0900 hours on Sunday. Place a portable changeable message sign as shown on the Traffic Handling Details Plan. Close Olympic Blvd/Eastern Ave on-ramp.	

Note: Outside shoulder slabs may be reconstructed concurrently with the adjacent freeway slab.

TABLE 9

Permissible Hours of Lane Closures for  
Concrete Approach Slab Replacement

Location: SB Route 710; At Route 5/710 Sep

Slab No. Being Replaced	Lane No. Closed	Remove, Replace, and Cure Slabs
		Closure Hours
1	1 & 2	0100 Sunday to 1000 Sunday
2	1, 2 & 3	0100 Sunday to 0900 Sunday
3	2 & 3	0100 Sunday to 0900 Sunday
Slab No. Being Replaced	Other Closure Requirements	
1	<p>Open Lane No. 2 by 0800 hours on Sunday. Close SB Route 710 to SB Route 5 connector and detour traffic as shown on Chart 39 (Alternate Detour 1). Close Olympic Blvd/Eastern Ave on-ramp.</p>	
2	<p>Open Lane No. 1 by 0700 hours on Sunday. Close SB Route 710 at SB Route 5 off-connector. Detour traffic onto SB Route 5 and exit at Atlantic Blvd/Eastern Ave off-ramp; south on Eastern Ave; west on Washington Blvd to the on-ramp to SB Route 710. Place a portable changeable message sign on SB Route 710 inside the closure near the Olympic Blvd off-ramp gore with the message: "FREEWAY/CLOSED/AHEAD - USE S5/TO/ATLANTIC". Place a second portable changeable message sign on SB Route 5 at the gore of Triggs St off-ramp with the message: "S 710/DETOUR/TRAFFIC - EXIT/AT/ATLANTIC". A minimum of 11 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure. Place a portable changeable message sign as shown on the Traffic Handling Details Plan. Close Olympic Blvd/Eastern Ave on-ramp.</p>	
3	<p>Open Lane No. 2 by 0700 hours on Sunday. Place a portable changeable message sign as shown on the Traffic Handling Details Plan. Close Olympic Blvd/Eastern Ave on-ramp.</p>	

Note: Median or outside shoulder slabs may be reconstructed concurrently with the adjacent freeway slab.

TABLE 10

Permissible Hours of Lane Closures for  
Concrete Slab Replacement

Location: SB Route 710; Bandini Blvd UC to Atlantic Blvd UC

Slab No. Being Replaced	Lane No. Closed	Remove, Replace, and Cure Slabs
		Closure Hours
2 or 2, 3 & 4	2, 3 & 4	0001 Saturday to 0700 Saturday 0100 Sunday to 0900 Sunday
3 or 3 & 4	3 & 4	2200 Friday to 0700 Saturday 2300 Saturday to 0900 Sunday
4	4	2000 Friday to 0900 Saturday 2000 Saturday to 1100 Sunday
Slab No. Being Replaced	Other Closure Requirements	
2 or 2, 3 & 4	Close SB Route 5 to SB Route 710 connector and detour traffic as shown on Chart 37 (Alternate Detour 3). Close Washington Blvd on-ramp.	
3 or 3 & 4	Close Olympic Blvd/Eastern Ave on-ramp.	
4	None.	

Note: Outside shoulder slabs may be reconstructed concurrently with the adjacent freeway slab.

TABLE 11

PERMISSIBLE HOURS OF FULL FREEWAY CLOSURE  
FOR SET UP AND REMOVAL OF EXTENDED WEEKEND CLOSURES (STAGE 5 - PHASES 3 & 5)

LOCATION 1	SATURDAY MORNING	SUNDAY NIGHT THROUGH MONDAY MORNING
NB ROUTE 710 FLORENCE AVE TO ATLANTIC BLVD	0001 HRS. – 0600 HRS.	2300 HRS. – 0500 HRS.
<p>Detour traffic to exit at Florence Ave off-ramp; west on Florence Ave; north on Atlantic Ave (Blvd) to the on-ramp to NB Route 710. A minimum of 4 special freeway detour signs (SP-2), as shown on plans, shall be posted at the beginning of the detour route and shall be removed at the end of each closure.</p> <p>Place a PCMS on the right shoulder of NB Route 710 just north of the South Gate UPRR with the message: "N710/TRAFFIC – DETOUR/FLORENCE/WEST". Place a second PCMS on the right shoulder of NB Route 710 in advance of Firestone Blvd off-ramp with the message: "FREEWAY/CLOSED/AHEAD – FLORENCE/TO/ATLANTIC".</p> <p>Close Florence Ave on-ramps.</p>		
SB ROUTE 710 WASHINGTON BLVD TO FLORENCE AVE	0001 HRS. – 0600 HRS.	2300 HRS. – 0500 HRS.
<p>Detour traffic to exit at Washington Blvd off-ramp; east on Washington Blvd; south on Atlantic Blvd (Ave); east on Florence Ave to the on-ramp to SB Route 710. A minimum of 4 special freeway detour signs (SP-2), as shown on plans, shall be posted at the beginning of the detour route and shall be removed at the end of each closure.</p> <p>Place a PCMS on the right shoulder of SB Route 710 in the gore area from Route 60 on-connector with the message: "FREEWAY/CLOSED/AHEAD - WASHNGTN/TO/FLORENCE". Place a second PCMS on the right shoulder of SB Route 710 in advance of the Cesar Chavez Ave off-ramp with the message: "FREEWAY/CLOSED – WASHNGTN/TO/FLORENCE".</p> <p>Close SB Route 5 to SB Route 710 connector and detour traffic to exit at Atlantic Blvd/Eastern Ave off-ramp; south on Eastern Ave; west on Washington Blvd; south on Atlantic Blvd (Ave); east on Florence Ave to the on-ramp to SB Route 710. Place a portable changeable message sign inside the connector closure with the message: "S710/EXIT/CLOSED - DETOUR/USE/ATLANTIC". A minimum of 29 special freeway detour signs (SP-2), as shown on plans, shall be posted along the detour route and shall be removed at the end of each closure.</p> <p>Close Washington Blvd and Atlantic Blvd on-ramps.</p>		

PCMS = Portable Changeable Message Sign

**10-1.22 CLOSURE REQUIREMENTS AND CONDITIONS**

Closures shall conform to the provisions in "Maintaining Traffic" of these special provisions and these special provisions.

**CLOSURE SCHEDULE**

A schedule of planned closures for the next week period, defined as Friday noon through the following Friday noon, shall be submitted by noon each Monday. A written schedule shall be submitted not less than 25 days and not more than 125 days before the anticipated start of any operation that will:

1. Reduce horizontal clearances, traveled way, including shoulders, to two lanes or less due to such operations as temporary barrier placement and paving
2. Reduce the vertical clearances available to the public due to such operations as pavement overlay, overhead sign installation, or falsework or girder erection

The Closure Schedule shall show the locations and times of the proposed closures. The online Lane Closure System (LCS) at <http://lcs.dot.ca.gov> shall be used. Closure Schedules submitted to the Engineer with incomplete or inaccurate information will be rejected and returned for correction and resubmittal online. The Contractor will be notified of disapproved closures or closures that require coordination with other parties as a condition of approval. The Contractor shall contact the Engineer to schedule required LCS training 2 weeks before submitting the first lane closure request.

Closure Schedule amendments, including adding additional closures, shall be submitted online by noon to the Engineer, at least 3 business days in advance of a planned closure. Approval of Closure Schedule amendments will be at the discretion of the Engineer.

The Contractor shall cancel lane closure requests that are not needed at least 2 business days via the online system before the date of closure.

Closures that are cancelled due to unsuitable weather may be rescheduled at the discretion of the Engineer.

**CONTINGENCY PLAN**

A detailed contingency plan shall be prepared for reopening closures to public traffic. If required by "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions, the contingency plan shall be submitted to the Engineer before work at the job site begins. Otherwise, the contingency plan shall be submitted to the Engineer within one business day of the Engineer's request.

**LATE REOPENING OF CLOSURES**

If a closure is not reopened to public traffic by the specified time, work shall be suspended in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications. No further closures are to be made until the Engineer has accepted a work plan, submitted by the Contractor, that will insure that future closures will be reopened to public traffic at the specified time. The Engineer will have 2 business days to accept or reject the Contractor's proposed work plan. The Contractor will not be entitled to compensation for the suspension of work resulting from the late reopening of closures.

For each 10-minute interval, or fraction thereof past the time specified to reopen the closure (except for shoulders), the Department will deduct the amount per interval shown below from moneys due or that may become due the Contractor under the contract. Damages are limited to 5 percent of project cost per occurrence and will not be assessed when the Engineer requests that the closure remain in place beyond the scheduled pickup time.

Type of Facility	Route or Segment	Period	Damages/interval (\$)
Mainline	5	1st half hour	\$2,500 / 10 minutes
		2nd half hour	\$3,800 / 10 minutes
		2nd hour and beyond	\$5,100 / 10 minutes
Mainline	710	1st half hour	\$1,500 / 10 minutes
		2nd half hour	\$2,200 / 10 minutes
		2nd hour and beyond	\$3,000 / 10 minutes

**COMPENSATION**

The Engineer shall be notified of delays in the Contractor's operations due to the following conditions, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of those conditions, and the Contractor's loss due to that delay could not have been avoided by rescheduling the affected closure or by judicious handling of forces, equipment and plant, the delay will be considered a right of way delay and will be compensated in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications:

1. The Contractor's proposed Closure Schedule is denied and his planned closures are within the time frame allowed for closures in "Maintaining Traffic" of these special provisions, except that the Contractor will not be entitled to compensation for amendments to the Closure Schedule that are not approved.
2. The Contractor is denied a confirmed closure.

Should the Engineer direct the Contractor to remove a closure before the time designated in the approved Closure Schedule, delay to the Contractor's schedule due to removal of the closure will be considered a right of way delay and compensation for the delay will be determined in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

## 10-1.23 IMPACT ATTENUATOR VEHICLE

### GENERAL

#### Summary

Work includes protecting traffic and workers by using impact attenuator vehicle as a shadow vehicle when placing and removing components of a traffic control system, and when performing a moving lane closure.

Comply with Section 12-3.03, "Flashing Arrow Signs," of the Standard Specifications.

Impact attenuator vehicle must comply with the following test levels under National Cooperative Highway Research Program 350:

1. Test level 3 for pre-construction posted speed limit of 50 mph or more
2. Test levels 2 or 3 for pre-construction posted speed limit of 45 mph or less

Comply with the attenuator manufacturer's recommendations for:

1. Support truck
2. Trailer-mounted operation
3. Truck-mounted operation

#### Definitions

**impact attenuator vehicle:** Support truck towing a deployed attenuator mounted to a trailer or support truck with a deployed attenuator mounted to the support truck.

#### Submittals

Upon request, submit a Certificate of Compliance for attenuator to the Engineer under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

#### Quality Control and Assurance

Attenuator must be a brand listed on the Department's pre-approved list under Highway Safety Features at:

[http://www.dot.ca.gov/hq/esc/approved\\_products\\_list/](http://www.dot.ca.gov/hq/esc/approved_products_list/)

### MATERIALS

The combined weight of the support truck and the attenuator must be at least 19,800 pounds, except the weight of the support truck must not be less than 16,100 pounds or greater than 26,400 pounds.

If using the Trinity MPS-350 truck-mounted attenuator, the support truck must not have any underneath fuel tank mounted within 10'-6" of the rear of the support truck.

Each impact attenuator vehicle must:

1. Have standard brake lights, taillights, sidelights, and turn signals
2. Have an inverted "V" chevron pattern placed across the entire rear of the attenuator composed of alternating 4 inch wide non-reflective black stripes and 4 inch wide yellow retroreflective stripes sloping at 45 degrees
3. Have a Type II flashing arrow sign
4. Have a flashing or rotating amber light
5. Have an operable 2-way communication system for maintaining contact with workers

### CONSTRUCTION

Use impact attenuator vehicle to follow behind equipment and workers who are placing and removing components of a traffic control system for a lane closure or a ramp closure. Flashing arrow sign must be operating in arrow mode during this activity. Follow at a distance to prevent intrusion into the workspace from passing traffic.

After placing components of a traffic control system for a lane closure or a ramp closure you may use impact attenuator vehicle in a closed lane and in advance of a work area to protect traffic and workers.

Use impact attenuator vehicle as a shadow vehicle under traffic control for a moving lane closure.

Secure objects including equipment, tools and ballast on impact attenuator vehicle to prevent loosening upon impact by an errant vehicle.

Do not use a damaged attenuator in the work. Replace, at your expense, an attenuator damaged from an impact during work.

## **MEASUREMENT AND PAYMENT**

Full compensation for furnishing and operating impact attenuator vehicle is included in the contract lump sum price paid for traffic control system, and no additional compensation will be allowed therefor.

### **10-1.24 TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE**

A traffic control system shall consist of closing traffic lanes and ramps in conformance with the details shown on the plans, the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications, the provisions under "Maintaining Traffic" and "Construction Area Signs" of these special provisions, and these special provisions.

The provisions in this section will not relieve the Contractor of responsibility for providing additional devices or taking measures as may be necessary to comply with the provisions in Section 7-1.09, "Public Safety," of the Standard Specifications.

During traffic stripe operations and pavement marker placement operations using bituminous adhesive, traffic shall be controlled, at the option of the Contractor, with either stationary or moving lane closures. During other operations, traffic shall be controlled with stationary lane closures. Attention is directed to the provisions in Section 84-1.04, "Protection From Damage," and Section 85-1.06, "Placement," of the Standard Specifications.

If components in the traffic control system are displaced or cease to operate or function as specified, from any cause, during the progress of the work, the Contractor shall immediately repair the components to the original condition or replace the components and shall restore the components to the original location.

### **STATIONARY LANE CLOSURE**

When lane and ramp closures are made for work periods only, at the end of each work period, components of the traffic control system, except portable delineators placed along open trenches or excavation adjacent to the traveled way, shall be removed from the traveled way and shoulder. If the Contractor so elects, the components may be stored at selected central locations, designated by the Engineer within the limits of the highway right of way.

Each vehicle used to place, maintain and remove components of a traffic control system on multilane highways shall be equipped with a Type II flashing arrow sign which shall be in operation when the vehicle is being used for placing, maintaining or removing the components. Vehicles equipped with Type II flashing arrow sign not involved in placing, maintaining or removing the components when operated within a stationary type lane closure shall only display the caution display mode. The sign shall be controllable by the operator of the vehicle while the vehicle is in motion. The flashing arrow sign shown on the plans shall not be used on the vehicles which are doing the placing, maintaining and removing of components of a traffic control system and shall be in place before a lane closure requiring the sign's use is completed.

### **MOVING LANE CLOSURE**

Flashing arrow signs used in moving lane closures shall be truck-mounted. Changeable message signs used in moving lane closure operations shall conform to the provisions in Section 12-3.12, "Portable Changeable Message Signs," of the Standard Specifications, except the signs shall be truck-mounted and the full operation height of the bottom of the sign may be less than 7 feet above the ground, but should be as high as practicable.

Flashing arrow signs shall be in the caution display mode when used on 2-lane, 2-way highways.

Truck-mounted attenuators (TMA) for use in moving lane closures shall be any of the following approved models, or equal:

1. Hexfoam TMA Series 3000, Alpha 1000 TMA Series 1000, and Alpha 2001 TMA Series 2001, manufactured by Energy Absorption Systems, Inc., 35 East Wacker Drive, Suite 1100, Chicago, IL 60601:
  - 1.1. Northern California: Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828, telephone (800) 884-8274, FAX (916) 387-9734
  - 1.2. Southern California: Traffic Control Service, Inc., 1818 E. Orangethorpe, Fullerton, CA 92831-5324, telephone (800) 222-8274, FAX (714) 526-9501
2. Cal T-001 Model 2 or Model 3, manufacturer and distributor: Hexcel Corporation, 11711 Dublin Boulevard, P.O. Box 2312, Dublin, CA 94568, telephone (925) 551-4900
3. Renco Rengard Model Nos. CAM 8-815 and RAM 8-815, manufacturer and distributor: Renco Inc., 1582 Pflugerville Loop Road, P.O. Box 730, Pflugerville, TX 78660-0730, telephone (800) 654-8182

Each TMA shall be individually identified with the manufacturer's name, address, TMA model number, and a specific serial number. The names and numbers shall each be a minimum 1/2 inch high and located on the left (street) side at the lower front corner. The TMA shall have a message next to the name and model number in 1/2 inch high letters which states, "The bottom of this TMA shall be \_\_\_\_\_ inches  $\pm$  \_\_\_\_\_ inch above the ground at all points for proper impact performance." Any TMA which is damaged or appears to be in poor condition shall not be used unless recertified by the manufacturer. The Engineer shall be the sole judge as to whether used TMAs supplied under this contract need recertification. Each unit shall be certified by the manufacturer to meet the requirements for TMA in conformance with the standards established by the Transportation Laboratory.

Approvals for new TMA designs proposed as equal to the above approved models shall be in conformance with the procedures (including crash testing) established by the Transportation Laboratory. For information regarding submittal of new designs for evaluation contact: Transportation Laboratory, 5900 Folsom Boulevard, Sacramento, California 95819.

New TMAs proposed as equal to approved TMAs or approved TMAs determined by the Engineer to need recertification shall not be used until approved or recertified by the Transportation Laboratory.

## **PAYMENT**

The contract lump sum price paid for traffic control system shall include full compensation for furnishing all labor, materials (including signs), tools, equipment, and incidentals, and for doing all the work involved in placing, removing, storing, maintaining, moving to new locations, replacing and disposing of the components of the traffic control system shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The adjustment provisions in Section 4-1.03, "Changes," of the Standard Specifications shall not apply to the item of traffic control system. Adjustments in compensation for traffic control system will be made only for increased or decreased traffic control system required by changes ordered by the Engineer and will be made on the basis of the cost of the increased or decreased traffic control necessary. The adjustment will be made on a force account basis as provided in Section 9-1.03, "Force Account Payment," of the Standard Specifications for increased work and estimated on the same basis in the case of decreased work.

Traffic control system required by work which is classed as extra work, as provided in Section 4-1.03D of the Standard Specifications, will be paid for as a part of the extra work.

## **10-1.25 TEMPORARY PAVEMENT DELINEATION**

Temporary pavement delineation shall be furnished, placed, maintained, and removed in conformance with the provisions in Section 12-3.01, "General," of the Standard Specifications and these special provisions. Nothing in these special provisions shall be construed as reducing the minimum standards specified in the California MUTCD or as relieving the Contractor from the responsibilities specified in Section 7-1.09, "Public Safety," of the Standard Specifications.

## **GENERAL**

When the work causes obliteration of pavement delineation, temporary or permanent pavement delineation shall be in place before opening the traveled way to public traffic. Lane pavement delineation shall be provided for traveled ways open to public traffic. On multilane roadways (freeways and expressways) edgeline delineation shall be provided for traveled ways open to public traffic.

The Contractor shall perform the work necessary to establish the alignment of temporary pavement delineation, including required lines or markers. Surfaces to receive application of paint or removable traffic tape temporary pavement delineation shall be dry and free of dirt and loose material. Temporary pavement delineation shall not be applied over existing pavement delineation or other temporary pavement delineation. Temporary pavement delineation shall be maintained until superseded or replaced with a new pattern of temporary pavement delineation or permanent pavement delineation, or as determined by the Engineer.

Temporary pavement markers, including underlying adhesive, and removable traffic tape that are applied to the final layer of surfacing or existing pavement to remain in place or that conflicts with a subsequent or new traffic pattern for the area shall be removed when no longer required for the direction of public traffic, as determined by the Engineer.

## **TEMPORARY LANELINE DELINEATION**

When lanelines are obliterated and temporary pavement delineation to replace the lines is not shown on the plans, the minimum laneline delineation to be provided for that area shall be temporary pavement markers placed at longitudinal intervals of not more than 24 feet. The temporary pavement markers shall be the same color as the laneline the pavement markers replace. Temporary pavement markers shall be, at the option of the Contractor, one of the temporary pavement markers listed for short term day/night use (14 days or less) or long term day/night use (180 days or less) in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. The temporary pavement markers shall be placed in conformance with the manufacturer's instructions. Temporary pavement markers for long term day/night use (180 days or less) shall be cemented to the surfacing with the adhesive recommended by the manufacturer, except epoxy adhesive shall not be used to place the temporary pavement markers in areas where removal of the temporary pavement markers will be required.

Temporary laneline delineation consisting entirely of temporary pavement markers listed for short term day/night use (14 days or less), shall be placed on longitudinal intervals of not more than 24 feet and shall be used for a maximum of 14 days on lanes opened to public traffic. Before the end of the 14 days the permanent pavement delineation shall be placed. If the permanent pavement delineation is not placed within the 14 days, the Contractor shall replace the temporary pavement markers and provide additional temporary pavement delineation and shall bear the cost thereof. The additional temporary pavement delineation to be provided shall be equivalent to the pattern specified for the permanent pavement delineation for the area, as determined by the Engineer.

## **TEMPORARY EDGELINE DELINEATION**

On multilane roadways (freeways and expressways), when edgelines are obliterated and temporary pavement delineation to replace those edgelines is not shown on the plans, the edgeline delineation to be provided for those areas adjacent to lanes open to public traffic shall be as follows:

1. Temporary pavement delineation for right edgelines shall, at the option of the Contractor, consist of either a solid 4-inch wide traffic stripe tape of the same color as the stripe it replaces, traffic cones, portable delineators or channelizers placed at longitudinal intervals not to exceed 100 feet.
2. Temporary pavement delineation for left edgelines shall, at the option of the Contractor, consist of either solid 4-inch wide traffic stripe tape of the same color as the stripe it replaces, traffic cones, portable delineators or channelizers placed at longitudinal intervals not to exceed 100 feet or temporary pavement markers placed at longitudinal intervals of not more than 6 feet.

Where removal of the 4-inch wide traffic stripe will not be required, painted traffic stripe conforming to the provisions of "Temporary Traffic Stripe (Paint)" of these special provisions may be used.

The lateral offset for traffic cones, portable delineators or channelizers used for temporary edgeline delineation shall be as determined by the Engineer. If traffic cones or portable delineators are used as temporary pavement delineation for edgelines, the Contractor shall provide personnel to remain at the project site to maintain the cones or delineators during the hours of the day that the portable delineators are in use.

Channelizers used for temporary edgeline delineation shall be the surface mounted type and shall be orange in color. Channelizer bases shall be cemented to the pavement in the same manner provided for cementing pavement markers to pavement in "Pavement Markers" of these special provisions, except epoxy adhesive shall not be used to place channelizers on the top layer of pavement. Channelizers shall be, at the Contractor's option, one of the surface mount types (36 inch) listed in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

Temporary edgeline delineation shall be removed when no longer required for the direction of public traffic as determined by the Engineer.

## **TEMPORARY TRAFFIC STRIPE (TAPE)**

The temporary traffic stripe tape shall be complete in place at the location shown before opening the traveled way to public traffic.

Removable traffic stripe tape shall be the temporary removable traffic stripe tape as listed in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

Removable traffic stripe tape shall be applied in conformance with the manufacturer's installation instructions and shall be rolled slowly with a rubber tired vehicle or roller to ensure complete contact with the pavement surface. Traffic stripe tape shall be applied straight on tangent alignment and on a true arc on curved alignment. Traffic stripe tape shall not be applied when the air or pavement temperature is less than 50°F, unless the installation procedures to be used are approved by the Engineer, before beginning installation of the tape.

### **TEMPORARY TRAFFIC STRIPE (PAINT)**

The painted temporary traffic stripe shall be complete in place at the location shown before opening the traveled way to public traffic. Removal of painted temporary traffic stripe will be required.

Temporary painted traffic stripe shall conform to the provisions in "Paint Traffic Stripe and Pavement Marking" of these special provisions, except for payment. At the option of the Contractor, either one or 2 coats shall be applied regardless of whether on new or existing pavement.

### **TEMPORARY PAVEMENT MARKERS**

Temporary pavement markers shall be applied complete in place before opening the traveled way to public traffic.

Temporary pavement markers shall be, at the option of the Contractor, one of the temporary pavement markers for long term day/night use (180 days or less) listed in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

Temporary pavement markers shall be placed in conformance with the manufacturer's instructions and shall be cemented to the surfacing with the adhesive recommended by the manufacturer, except epoxy adhesive shall not be used in areas where removal of the pavement markers will be required.

Retroreflective pavement markers conforming to the provisions in "Pavement Markers" of these special provisions shall be used in place of temporary pavement markers for long term day/night use (180 days or less) except to simulate patterns of broken traffic stripe. Placement of the retroreflective pavement markers used for temporary pavement markers shall conform to the provisions in "Pavement Markers" of these special provisions except the waiting period provisions before placing the pavement markers on new hot mix asphalt surfacing as specified in Section 85-1.06, "Placement," of the Standard Specifications shall not apply and epoxy adhesive shall not be used to place pavement markers in areas where removal of the pavement markers will be required.

### **MEASUREMENT AND PAYMENT**

Temporary traffic stripe shown on the plans will be measured and paid for in the same manner specified for paint traffic stripe in Section 84-3.06, "Measurement," and Section 84-3.07, "Payment," of the Standard Specifications.

Temporary pavement markers shown on the plans will be measured and paid for by the unit in the same manner specified for retroreflective pavement markers in Section 85-1.08, "Measurement," and Section 85-1.09, "Payment," of the Standard Specifications.

Full compensation for furnishing, placing, maintaining, and removing the temporary pavement markers (including underlying adhesive, layout (dribble) lines to establish alignment of temporary pavement markers or used for temporary laneline and centerline delineation) for those areas where temporary laneline and centerline delineation is not shown on the plans and for providing equivalent patterns of permanent traffic lines for those areas when required, shall be considered as included in the contract prices paid for the items of work that obliterated the laneline and centerline pavement delineation and no separate payment will be made therefor.

Full compensation for furnishing, placing, maintaining, and removing temporary edgeline delineation not shown on the plans shall be considered as included in the contract prices paid for the items of work that obliterated the edgeline pavement delineation and no separate payment will be made therefor. The quantity of channelizers used as temporary edgeline delineation will not be included in the quantity of channelizer (surface mounted) to be paid for.

### **10-1.26 BARRICADE**

Barricades shall be furnished, placed and maintained at the locations shown on the plans, specified in the Standard Specifications or in these special provisions or where designated by the Engineer. Barricades shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Attention is directed to "Prequalified and Tested Signing and Delineation Materials" of these special provisions regarding retroreflective sheeting for barricades.

Construction area sign and marker panels conforming to the provisions in Section 12-3.06, "Construction Area Signs," of the Standard Specifications shall be installed on barricades in a manner determined by the Engineer at the locations shown on the plans.

Sign panels for construction area signs and marker panels installed on barricades shall conform to the provisions in Section 12-3.06A, "Stationary Mounted Signs," of the Standard Specifications.

Full compensation for furnishing, installing, maintaining, and removing construction area signs and marker panels on barricades shall be considered as included in the contract unit price paid for the type of barricade involved and no separate payment will be made therefor.

Barricades shown on the plans as part of a traffic control system will be paid for as provided in "Traffic Control System for Lane Closure" of these special provisions and will not be included in the count for payment of barricades.

## **10-1.27 PORTABLE CHANGEABLE MESSAGE SIGNS**

### **GENERAL**

#### **Summary**

Work includes furnishing, placing, operating, maintaining, and removing portable changeable message signs. Comply with Section 12-3.12 "Portable Changeable Message Signs," of the Standard Specifications.

#### **Definitions**

**useable shoulder area:** Paved or unpaved contiguous surface adjacent to the traveled way with:

1. Sufficient weight bearing capacity to support portable changeable message sign
2. Slope not greater than 6:1 (horizontal:vertical)

#### **Submittals**

Upon request, submit a Certificate of Compliance for each portable changeable message sign under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

#### **Quality Control and Assurance**

Comply with the manufacturer's operating instructions for portable changeable message sign.

Approaching drivers must be able to read the entire message for all phases at least twice at the posted speed limit before passing portable changeable message sign. You may use more than 1 portable changeable message sign to meet this requirement.

Only display the message shown on the plans or ordered by the Engineer or specified in these special provisions.

### **MATERIALS**

Portable changeable message sign must have 24-hour timer control or remote control capability.

The text of the message displayed on portable changeable message sign must not scroll, or travel horizontally or vertically across the face of the message panel.

### **CONSTRUCTION**

Continuously repeat the entire message in no more than 2 phases of at least 3 seconds per phase.

If useable shoulder area is at least 15 feet wide, the displayed message on portable changeable message sign must be minimum 18-inch character height. If useable shoulder area is less than 15 feet wide, you may use a smaller message panel with minimum 12-inch character height to prevent encroachment in the traveled way.

You or your representative must be available by cell phone for operations that require portable changeable message signs. Give the Engineer your cell phone number. When the Engineer contacts you, immediately comply with the Engineer's request to modify the displayed message.

Start displaying the message on portable changeable message sign 5 minutes before closing the lane.

Place portable changeable message sign as far from the traveled way as practicable where it is legible to traffic and does not encroach on the traveled way. Place portable changeable sign before or at the crest of vertical roadway curvature where it is visible to approaching traffic. Avoid placing portable changeable message sign within or immediately after horizontal roadway curvature. Where possible, place portable changeable message sign behind guardrail or temporary railing (Type K).

Except where placed behind guardrail or temporary railing (Type K) use traffic control for shoulder closure to delineate portable changeable message sign.

Remove portable changeable message sign when not in use.

### **MEASUREMENT AND PAYMENT**

Full compensation for portable changeable message signs, including furnishing, placing, operating, modifying messages, maintaining, transporting from location to location, removing, and repairing or replacing defective or damaged portable changeable message signs is included in the contract lump sum price paid for traffic control system and no separate payment will be made therefor.

## **10-1.28 TEMPORARY TERMINAL SECTION (TYPE K)**

Temporary terminal section (Type K) for connecting temporary railing (Type K) to Type 50 concrete barrier shall consist of either new or undamaged used precast units, as shown on the plans. Fabricating, placing, painting, and removing the units shall conform to the provisions specified for temporary railing (Type K).

Closure plate for the temporary terminal section (Type K) shall be of a good commercial quality steel shaped to conform to cross section of the barriers. Mechanical expansion anchors for connecting closure plate to railings shall conform to the provisions specified for concrete anchorage devices in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Temporary terminal section (Type K) will be measured by the unit from actual count in place.

The contract unit price paid for temporary terminal section (Type K) shall include full compensation for furnishing all labor, materials (including reinforcement and concrete anchorage devices), tools, equipment, and incidentals, and for doing all the work involved in furnishing, placing, maintaining, repairing, replacing, and removing temporary terminal section (Type K), complete in place, including excavation, backfill, grout and concrete, and connecting to concrete barrier, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **10-1.29 CHANNELIZER (SURFACE MOUNTED)**

Channelizers shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Channelizers shall conform to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

When no longer required for the work as determined by the Engineer, channelizers (except channelizers to be left in place) and underlying adhesive used to cement the channelizer bases to the pavement shall be removed. Removed channelizers and adhesive shall become the property of the Contractor and shall be removed from the site of work.

#### **10-1.30 TRAFFIC PLASTIC DRUMS**

##### **GENERAL**

##### **Summary**

Work includes placing traffic plastic drums.

Comply with:

1. Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications
2. Section 6F.62, "Drums," of the California Manual On Uniform Traffic Control Devices
3. Traffic plastic drum manufacturer's recommendations for weight and ballast

##### **Definitions**

**orange-colored:** Orange-colored may be either orange, red-orange, fluorescent orange or fluorescent red-orange in color.

##### **Submittals**

Upon request, submit a Certificate of Compliance for Traffic Plastic Drum under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

##### **Quality Control and Assurance**

White and orange-colored retroreflective stripes must be a brand of retroreflective sheeting listed on the Department's "Prequalified and Tested Signing and Delineation Materials," of these special provisions. White and orange-colored stripe may be either Type III, Type IV, Type VI, Type VII, Type VIII, or Type IX retroreflective sheeting. Use the same type and brand of retroreflective sheeting for all traffic plastic drums.

##### **MATERIALS**

Traffic plastic drum must:

1. Be orange-colored low-density polyethylene
2. Be flexible and collapsible upon vehicle impact
3. Have a weighted-base to maintain an upright position and prevent displacement under passing traffic

Weighted-base must be:

1. Detachable
2. Shaped to prevent rolling upon impact
3. 38-inch maximum outside diameter
4. 4-inch maximum height above the ground surface

## **CONSTRUCTION**

Place a traffic plastic drum on only one side of the traveled way, in a straight line on a tangent alignment, and in a true arc on a curved alignment.

Use only one type of traffic plastic drum on the job site. Do not intermix traffic plastic drums, portable delineators, tubular markers, traffic cones, and Type I and Type II barricades on the same alignment.

Do not use sandbags or comparable ballast.

Traffic plastic drum must be a minimum of 36 inches in height above the traveled way.

Immediately restore a displaced traffic plastic drum to its original location and upright position.

Upon completion of work, traffic plastic drums become your property and must be removed from the job site.

## **MEASUREMENT AND PAYMENT**

Full compensation for furnishing, placing, maintaining and removing plastic traffic drums as shown on the plans shall be considered as included in the contract lump sum price paid for traffic control system and no separate payment will be made therefor.

### **10-1.31 TEMPORARY TRAFFIC SCREEN**

Temporary traffic screen shall be furnished, installed, and maintained on top of temporary railing (Type K) at the locations designated on the plans, specified in the special provisions or directed by the Engineer and shall conform to the provisions specified for traffic handling equipment and devices in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Temporary traffic screen panels shall be new or used CDX Grade, or better, plywood or weather resistant strandboard mounted and anchored on temporary railing (Type K). Wale boards shall be new or used Douglas fir, rough sawn, Construction Grade, or better. Pipe screen supports shall be new or used galvanized steel pipe, Schedule 40. Nuts, bolts, and washers shall be cadmium plated. Screws shall be black or cadmium plated flat head, cross slotted screws with full thread length.

When no longer required, as determined by the Engineer, temporary traffic screen shall be removed from the site of the work and shall become the property of the Contractor.

### **10-1.32 TEMPORARY CRASH CUSHION MODULE**

This work shall consist of furnishing, installing, and maintaining sand filled temporary crash cushion modules in groupings or arrays at each location shown on the plans, as specified in these special provisions or where designated by the Engineer. The grouping or array of sand filled modules shall form a complete sand filled temporary crash cushion in conformance with the details shown on the plans and these special provisions.

Temporary crash cushions shall be secured in place prior to commencing work for which the temporary crash cushions are required.

Whenever the work or the Contractor's operations establishes a fixed obstacle, the exposed fixed obstacle shall be protected with a sand filled temporary crash cushion. The sand filled temporary crash cushion shall be in place prior to opening the lanes adjacent to the fixed obstacle to public traffic.

Sand filled temporary crash cushions shall be maintained in place at each location, including times when work is not actively in progress. Sand filled temporary crash cushions may be removed during a work period for access to the work provided that the exposed fixed obstacle is 15 feet or more from a lane carrying public traffic and the temporary crash cushion is reset to protect the obstacle prior to the end of the work period in which the fixed obstacle was exposed. When no longer required, as determined by the Engineer, sand filled temporary crash cushions shall be removed from the site of the work.

Sand filled temporary crash cushion modules shall be one of the following, or equal, and be manufactured after March 31, 1997:

1. Energite III and Fitch Inertial Modules, manufactured by Energy Absorption Systems, Inc., 35 East Wacker Drive, Suite 1100, Chicago, IL 60601:
  - 1.1. Northern California: Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828, telephone (800) 884-8274, FAX (916) 387-9734
  - 1.2. Southern California: Traffic Control Service, Inc., 1818 E. Orangethorpe, Fullerton, CA 92831-5324, telephone (800) 222-8274, FAX (714) 526-9501

2. Traffix Sand Barrels, manufactured by Traffix Devices, Inc., 220 Calle Pintesco, San Clemente, CA 92672, telephone (949) 361-5663, FAX (949) 361-9205
  - 2.1. Northern California: United Rentals, Inc., 1533 Berger Drive, San Jose, CA 95112, telephone (408) 287-4303, FAX (408) 287-1929
  - 2.2. Southern California: Statewide Safety & Sign, Inc., P.O. Box 1440, Pismo Beach, CA 93448, telephone (800) 559-7080, FAX (805) 929-5786
3. CrashGard Model CC-48 Sand Barrels, manufactured by Plastic Safety Systems, Inc., 2444 Baldwin Road, Cleveland, OH 44104:
  - 3.1. Northern California:
    - 3.1.1. Capitol Barricade Safety & Sign, 6329 Elvas Ave, Sacramento, CA 95819, telephone (888) 868-5021, FAX (916) 451-5388
    - 3.1.2. Sierra Safety, Inc., 9093 Old State Highway, New Castle, CA 95658, telephone (916) 663-2026, FAX (916) 663-1858
  - 3.2. Southern California: Hi Way Safety Inc., 13310 5th Street, Chino, CA 91710, telephone (909) 591-1781, FAX (909) 627-0999

Modules contained in each temporary crash cushion shall be of the same type at each location. The color of the modules shall be the standard yellow color, as furnished by the vendor, with black lids. The modules shall exhibit good workmanship free from structural flaws and objectionable surface defects. The modules need not be new. Good used undamaged modules conforming to color and quality of the types specified herein may be utilized. If used Fitch modules requiring a seal are furnished, the top edge of the seal shall be securely fastened to the wall of the module by a continuous strip of heavy duty tape.

Modules shall be filled with sand in conformance with the manufacturer's directions, and to the sand capacity in pounds for each module shown on the plans. Sand for filling the modules shall be clean washed concrete sand of commercial quality. At the time of placing in the modules, the sand shall contain not more than 7 percent water as determined by California Test 226.

Modules damaged due to the Contractor's operations shall be repaired immediately by the Contractor at the Contractor's expense. Modules damaged beyond repair, as determined by the Engineer, due to the Contractor's operations shall be removed and replaced by the Contractor at the Contractor's expense.

Temporary crash cushion modules may be placed on movable pallets or frames. Comply with dimensions shown on the plans. The pallets or frames shall provide a full bearing base beneath the modules. The modules and supporting pallets or frames shall not be moved by sliding or skidding along the pavement or bridge deck.

A Type R or P marker panel shall be attached to the front of the crash cushion as shown on the plans, when the closest point of the crash cushion array is within 12 feet of the traveled way. The marker panel, when required, shall be firmly fastened to the crash cushion with commercial quality hardware or by other methods determined by the Engineer.

At the completion of the project, temporary crash cushion modules, sand filling, pallets or frames, and marker panels shall become the property of the Contractor and shall be removed from the site of the work. Temporary crash cushion modules shall not be installed in the permanent work.

Temporary crash cushion modules will be measured by the unit as determined from the actual count of modules used in the work or ordered by the Engineer at each location. Temporary crash cushion modules placed in conformance with Section 7-1.09, "Public Safety," of the Standard Specifications and modules placed in excess of the number specified or shown will not be measured nor paid for.

Repairing modules damaged by public traffic will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications. Modules damaged beyond repair by public traffic, when ordered by the Engineer, shall be removed and replaced immediately by the Contractor. Modules replaced due to damage by public traffic will be measured and paid for as temporary crash cushion module.

If the Engineer orders a lateral move of the sand filled temporary crash cushions and the repositioning is not shown on the plans, moving the sand filled temporary crash cushion will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications and these temporary crash cushion modules will not be counted for payment in the new position.

The contract unit price paid for temporary crash cushion module shall include full compensation for furnishing all labor, materials (including sand, pallets or frames and marker panels), tools, equipment, and incidentals, and for doing all the work involved in furnishing, installing, maintaining, moving, and resetting during a work period for access to the work, and removing from the site of the work when no longer required (including those damaged by public traffic) sand filled temporary crash cushion modules, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

### **10-1.33 REMOVE YELLOW TRAFFIC STRIPE AND PAVEMENT MARKING (HAZARDOUS WASTE)**

#### **GENERAL**

##### **Summary**

This work includes removing existing yellow thermoplastic and yellow painted traffic stripe and pavement marking at the locations shown on the plans. The residue from the removal of this material is a hazardous waste.

Residue from removal of yellow thermoplastic and yellow painted traffic stripe and pavement marking contains lead chromate. The average lead concentration is greater than or equal to 1000 mg/kg total lead or 5 mg/l soluble lead. When applied to the roadway, the yellow thermoplastic and yellow painted traffic stripe and pavement marking contained as much as 2.6 percent lead. Residue produced from the removal of this yellow thermoplastic and yellow painted traffic stripe and pavement marking contains heavy metals in concentrations that exceed thresholds established by the Health and Safety Code and 22 CA Code of Regs. For bidding purposes, assume that the residue is not regulated under the Federal Resource Conservation and Recovery Act (RCRA), 42 USC § 6901 et seq.. Yellow thermoplastic and yellow paint may produce toxic fumes when heated.

##### **Submittals**

**Lead Compliance Plan:** Submit a lead compliance plan under Section 7-1.07, "Lead Compliance Plan," of the Standard Specifications.

**Work Plan:** Submit a work plan for the removal, containment, storage, and disposal of yellow thermoplastic and yellow painted traffic stripe and pavement marking for acceptance not less than 15 days prior to the start of the removal operations. The work plan must include:

1. Objective of the operation
2. Removal equipment
3. Type of hazardous waste storage containers
4. Container storage location and how it will be secured
5. Hazardous waste sampling protocol and QA/QC requirements and procedures
6. Qualifications of sampling personnel
7. Analytical lab that will perform the analyses
8. Certification documentation of the hazardous waste hauler that will transport the hazardous waste
9. Disposal site that will accept the hazardous waste residue

The Engineer will review the work plan within 5 business days of receipt.

Do not perform work that generates hazardous waste residue until the work plan has been accepted by the Engineer. The Engineer's review and acceptance does not waive any contract requirements and does not relieve the Contractor from complying with Federal, State, and local laws, regulations, and requirements.

Correct any rejected work plan and resubmit a corrected work plan within 5 business days of notification by the Engineer; at which time a new review period of 5 business days will begin.

**Analytical Test Results:** Submit analytical test results of the residue from removal of yellow thermoplastic and yellow painted traffic stripe and pavement marking, including chain of custody documentation, for review and acceptance before:

1. Requesting the Engineer's signature on the waste profile requested by the disposal facility
2. Requesting the Engineer obtain an EPA ID no. for disposal
3. Removing the residue from the site

**United States Environmental Protection Agency Identification Number Request:** Submit a request for the U.S. EPA ID no. when the Engineer accepts analytical test results documenting that residue from removal of yellow thermoplastic and yellow painted traffic stripe and pavement marking is a hazardous waste.

**Disposal Documentation:** Submit receiving landfill documentation of proper disposal within 5 business days of residue transport from the project.

## CONSTRUCTION

Where grinding or other approved methods are used to remove yellow thermoplastic and yellow painted traffic stripe and pavement marking that will produce a hazardous waste residue, the removed residue, including dust, must be contained and collected immediately. Use a HEPA filter-equipped vacuum attachment operated concurrently with the removal operations or other equally effective approved methods for collection of the residue.

Store hazardous waste residue in labeled and covered containers. Labels must comply with the provisions of 22 CA Code of Regs §§66262.31 and 66262.32. Mark labels with:

1. Date the hazardous waste is generated
2. The words "Hazardous Waste"
3. Composition and physical state of the hazardous waste (for example, asphalt grindings with thermoplastic or paint)
4. The word "Toxic"
5. Name, address, and telephone no. of the Engineer
6. Contract no.
7. Contractor or subcontractor name

Use metal containers approved by the U.S. Department of Transportation for the transportation and temporary storage of the removed residue. Handle the containers such that no spillage occurs. Store containers in a secured enclosure. Acceptable secure enclosures include a locked chain link fenced area or a lockable shipping container located within the project limits until disposal as approved.

Make necessary arrangements to test the yellow thermoplastic and yellow paint hazardous waste residue as required by the disposal facility and these special provisions. Testing must include, at a minimum:

1. Total lead by EPA Method 6010C
2. Total chromium by US EPA Method 7000 series
3. Soluble lead by California Waste Extraction Test
4. Soluble chromium by California Waste Extraction Test
5. Soluble lead by Toxicity Characteristic Leaching Procedure
6. Soluble chromium by Toxicity Characteristic Leaching Procedure

From the 1st 220 gallons of hazardous waste or portion thereof if less than 220 gallons of hazardous waste are produced, a minimum of 4 randomly selected samples must be taken and analyzed individually. Samples must not be composited. From each additional 880 gallons of hazardous waste or portion thereof if less than 880 gallons are produced, a minimum of 1 additional random sample must be taken and analyzed. Use chain of custody procedures consistent with Chapter 9 of U.S. EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846) while transporting samples from the project to the laboratory. Each sample must be homogenized before analysis by the laboratory performing the analyses. A sample aliquot sufficient to cover the amount necessary for the total and the soluble analyses must then be taken. This aliquot must be homogenized a 2nd time and the total and soluble analyses run on this aliquot. The homogenization process must not include grinding of the samples. Submit the name and location of the disposal facility that will be accepting the hazardous waste and the analytical laboratory along with the testing requirements not less than 5 business days before the start of removal of yellow thermoplastic and yellow painted traffic stripe and pavement marking. The analytical laboratory must be certified by the CA Department of Public Health Environmental Laboratory Accreditation Program for all analyses to be performed.

After the Engineer accepts the analytical test results, dispose of yellow thermoplastic and yellow paint hazardous waste residue at a Class 1 disposal facility located in CA under the requirements of the disposal facility operator within 30 days after accumulating 220 pounds of residue and dust.

If less than 220 pounds of hazardous waste residue and dust is generated in total, it must be disposed of within 30 days after the start of accumulation of the residue and dust.

Use a hazardous waste manifest and a transporter registered with the CA Department of Toxic Substance Control. The Engineer will obtain the U.S. EPA ID no. and will sign all manifests as the generator within 2 business days of receiving and accepting the analytical test results and receiving your request for the U.S. EPA ID no.

If analytical test results demonstrate that the residue is a non-hazardous waste and the Engineer agrees, dispose of the residue at an appropriately permitted Class II or Class III facility under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

## **MEASUREMENT AND PAYMENT**

The contract price paid per linear foot for remove yellow thermoplastic traffic stripe and remove yellow painted traffic stripe or per square foot for remove yellow thermoplastic pavement marking and remove yellow painted pavement marking includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all of the work involved in removal, containment, storage, and disposal, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for (1) work plan for the removal, containment, storage, and disposal of yellow thermoplastic and yellow painted traffic stripe and pavement marking hazardous waste residue, (2) analytical test results, (3) US EPA ID no. request, and (4) receiving landfill documentation of proper disposal are included in the contract prices paid per linear foot for remove yellow thermoplastic traffic stripe and remove yellow painted traffic stripe or per square foot for remove yellow thermoplastic pavement marking and remove yellow painted pavement marking and no separate payment will be made therefor.

Additional disposal costs for hazardous waste residue regulated under RCRA, as determined by test results, will be paid for as extra work as specified in Section 4-1.03D, "Extra Work," of the Standard Specifications.

If analytical test results demonstrate that the residue is a non-hazardous waste and the Engineer agrees to disposal at a non-hazardous waste disposal facility, no cost adjustment will be made.

### **10-1.34 TREATED WOOD WASTE**

#### **GENERAL**

##### **Summary**

This work includes handling, storing, transporting, and disposing of treated wood waste (TWW).

Wood removed from metal beam guard railings and roadside sign posts are treated with one or more of the following:

1. Creosote
2. Pentachlorophenol
3. Copper azole
4. Copper boron azole
5. Chromated copper arsenate
6. Ammoniacal copper zinc arsenate
7. Copper naphthenate
8. Alkaline copper quaternary

Manage TWW under Title 22 CA Code of Regulations, Division 4.5, Chapter 34.

##### **Submittals**

For disposal of TWW submit a copy of each completed shipping record and weight receipt to the Engineer within 5 business days of disposal.

#### **CONSTRUCTION**

Provide training to personnel who handle TWW or may come in contact with TWW that includes:

1. All applicable requirements of Title 8 CA Code of Regulations
2. Procedures for identifying and segregating TWW
3. Safe handling practices
4. Requirements of Title 22 CA Code of Regulations, Division 4.5, Chapter 34
5. Proper disposal methods

Store TWW before disposal using any of the following methods:

1. Elevate on blocks above a reasonably foreseeable run-on elevation and protect from precipitation
2. Place in water-resistant containers designed for shipping or solid waste collection
3. Place on a containment surface or pad protected from run-on and precipitation
4. Place in a storage building as defined in Title 22 CA Code of Regulations, Div. 4.5, Chp. 34, Section 67386.6 (a)(2)(c).

Prevent unauthorized access to TWW using a secured enclosure such as a locked chain link fenced area or a lockable shipping container located within the project limits.

Resize and segregate TWW at a location where debris from the operation including sawdust and chips can be contained. Collect and manage the debris as TWW.

Provide water-resistant labels, that comply with Title 22 CA Code of Regulations, Division 4.5, Chapter 34, to clearly mark and identify TWW and accumulation areas. Labels must include:

1. Caltrans, District number, Construction, contract number
2. District office address
3. Engineer's name, address, and telephone number
4. Contractor's contact name and telephone number
5. Date placed in storage

Before transporting TWW, obtain an agreement from the receiving facility that the treated wood waste will be accepted. Protect shipments of treated wood waste from loss and exposure to precipitation. For projects with 10,000 pounds or more of TWW, request a hazardous waste generator identification number from the Engineer at least 5 business days before the first shipment. Each shipment must be accompanied by a shipping record such as a bill of lading or invoice that includes:

1. Caltrans with district number
2. Construction contract number
3. District office address
4. Engineer's name, address, and telephone number
5. Contractor's contact name and telephone number
6. Receiving facility name and address
7. Waste description: treated wood waste (preservative type if known or unknown/mixture)
8. Project location
9. Estimated quantity of shipment by weight or volume
10. Date of transport
11. Date of receipt by the receiving TWW facility
12. Weight of shipment as measured by the receiving TWW facility
13. For projects with 10,000 pounds or more of TWW include the generator identification number

The shipping record must be at least a 4-part carbon or carbonless 8-1/2" x 11" form to allow retention of copies by the Engineer, transporter, and disposal facility.

Dispose of TWW at an approved TWW facility. A list of currently approved TWW facilities may be viewed at:

[http://www.dtsc.ca.gov/HazardousWaste/upload/TWW\\_Confirmed\\_Landfill\\_List.pdf](http://www.dtsc.ca.gov/HazardousWaste/upload/TWW_Confirmed_Landfill_List.pdf)

Dispose of TWW within:

1. 90 days of generation if stored on blocks
2. 180 days of generation if stored on a containment surface or pad.
3. One year of generation if filling a water-resistant container, or 90 days after the container is full, whichever is shorter
4. One year of generation if storing in a storage building as defined in Title 22 CA code of Regulations, Div. 4.5, Chp. 34, Section 67386.6(a)(2)(C)

### **MEASUREMENT AND PAYMENT**

Full compensation for handling, storing, transporting, and disposing TWW, including personnel training, is included in the contract price paid for the various items of work involved and no additional compensation will be allowed therefor.

### **10-1.35 EXISTING HIGHWAY FACILITIES**

The work performed in connection with various existing highway facilities shall conform to the provisions in Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

Except as otherwise provided for damaged materials in Section 15-2.04, "Salvage," of the Standard Specifications, the materials to be salvaged shall remain the property of the State, and shall be cleaned, packaged, bundled, tagged, and hauled to the District Recycle Center at 4425 East 3rd Street, Los Angeles, CA 90022 and stockpiled.

The Contractor shall notify the Engineer and the District Recycle Coordinator, telephone (323) 723-6366 a minimum of 48 hours prior to hauling salvaged material to the Recycle Center.

Attention is directed to Section 7-1.06, "Safety and Health Provisions," of the Standard Specifications. Work practices and worker health and safety shall conform to the California Division of Occupational Safety and Health Construction Safety Orders Title 8, of the California Code of Regulations including Section 5158, "Other Confined Space Operations."

Existing footing concrete that is below ground and outside of the footing limits shown on the contract plans or original contract plans shall be removed as directed by the Engineer and will be paid in conformance with Section 4-1.03D, "Extra Work," of the Standard Specifications.

### **EXISTING PAINT SYSTEMS**

The existing paint systems on Bridge Number 53-0828 consist of lead primer paints. Any work that disturbs the existing paint system will expose workers to health hazards and will (1) produce debris containing heavy metal in amounts that exceed the thresholds established in Titles 8 and 22 of the California Code of Regulations or (2) produce toxic fumes when heated. All debris produced when the existing paint system is disturbed shall be contained.

#### **Debris Containment and Collection Program**

Prior to starting work, the Contractor shall submit a debris containment and collection program to the Engineer in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, for debris produced when the existing paint system is disturbed. The program shall identify materials, equipment, and methods to be used when the existing paint system is disturbed and shall include working drawings of containment systems, loads applied to the bridge by containment structures, and provisions for ventilation and air movement for visibility and worker safety.

If the measures being taken by the Contractor are inadequate to provide for the containment and collection of debris produced when the existing paint system is disturbed, the Engineer will direct the Contractor to revise the operations and the debris containment and collection program. The directions will be in writing and will specify the items of work for which the Contractor's debris containment and collection program is inadequate. No further work shall be performed on the items until the debris containment and collection program is adequate and, if required, a revised program has been approved for the containment and collection of debris produced when the existing paint system is disturbed.

The Engineer will notify the Contractor of the approval or rejection of the submitted or revised debris containment and collection program within 2 weeks of submittal of the Contractor's program or revised program.

The State will not be liable to the Contractor for failure to approve all or any portion of an originally submitted or revised debris containment and collection program, nor for delays to the work due to the Contractor's failure to submit an acceptable program.

Full compensation for the debris containment and collection program shall be considered as included in the contract price paid for the item of work causing the existing paint system to be disturbed, and no additional compensation will be allowed therefor.

#### **Safety and Health Provisions**

Attention is directed to Section 7-1.06, "Safety and Health Provisions," of the Standard Specifications. Work practices and worker health and safety shall conform to the California Code of Regulations, Title 8, Construction Safety Orders, including Section 1532.1, "Lead."

The Contractor shall furnish the Engineer a written Code of Safe Practices and shall implement an Injury and Illness Prevention Program and a Hazard Communication Program in conformance with the requirements of Construction Safety Orders, Sections 1509 and 1510.

Prior to starting work that disturbs the existing paint system, and when revisions to the program are required by Section 1532.1, "Lead," the Contractor shall submit the compliance programs required in subsection (e)(2), "Compliance Program," of Section 1532.1, "Lead," of the Construction Safety Orders to the Engineer in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The compliance programs shall include the data specified in subsections (e)(2)(B) and (e)(2)(C) of Section 1532.1, "Lead." Approval of the compliance programs by the Engineer will not be required. The compliance programs shall be reviewed and signed by a Certified Industrial Hygienist (CIH) who is certified in comprehensive practice by the American Board of Industrial Hygiene (ABIH). Copies of all air monitoring or jobsite inspection reports made by or under the direction of the CIH in conformance with Section 1532.1, "Lead," shall be furnished to the Engineer within 10 days after the date of monitoring or inspection.

Full compensation for furnishing the Engineer with the submittals and for implementing the programs required by this safety and health section shall be considered as included in the contract price paid for the item of work causing the existing paint system to be disturbed, and no additional compensation will be allowed therefor.

### **Debris Handling**

Debris produced when the existing paint system is disturbed shall not be temporarily stored on the ground. Debris accumulated inside the containment system shall be removed before the end of each work shift. Debris shall be stored in approved, leakproof containers and shall be handled in such a manner that no spillage will occur.

Disposal of debris produced when the existing paint system is disturbed shall be performed in conformance with all applicable Federal, State, and local hazardous waste laws. Laws that govern this work include:

- A. Health and Safety Code, Division 20, Chapter 6.5 (California Hazardous Waste Control Act).
- B. Title 22; California Code of Regulations, Division 4.5, (Environmental Health Standards for the Management of Hazardous Waste).
- C. Title 8, California Code of Regulations.

Except as otherwise provided herein, debris produced when the existing paint system is disturbed shall be disposed of by the Contractor at an approved Class 1 disposal facility in conformance with the requirements of the disposal facility operator. The debris shall be hauled by a transporter currently registered with the California Department of Toxic Substances Control using correct manifesting procedures and vehicles displaying current certification of compliance. The Contractor shall make all arrangements with the operator of the disposal facility and perform any testing of the debris required by the operator.

At the option of the Contractor, the debris produced when the existing paint system is disturbed may be disposed of by the Contractor at a facility equipped to recycle the debris, subject to the following requirements:

- A. Copper slag abrasive blended by the supplier with a calcium silicate compound shall be used for blast cleaning.
- B. The debris produced when the existing paint system is disturbed shall be tested by the Contractor to confirm that the solubility of the heavy metals is below regulatory limits and that the debris may be transported to the recycling facility as a nonhazardous waste.
- C. The Contractor shall make all arrangements with the operator of the recycling facility and perform any testing of the debris produced when the existing paint system is disturbed that is required by the operator.

Full compensation for debris handling and disposal shall be considered as included in the contract price paid for the item of work causing the existing paint system to be disturbed, and no additional compensation will be allowed therefor.

### **Containment System**

At the option of the Contractor, the containment system shall consist of either: (1) vacuum shrouded surface preparation equipment and drapes, tarps, or other materials or (2) an equivalent containment system. The containment system shall contain all water, resulting debris, and visible dust produced when the existing paint system is disturbed.

Full compensation for the containment system shall be considered as included in the contract price paid for the item of work causing the existing paint system to be disturbed, and no additional compensation will be allowed therefor.

### **Protective Work Clothing and Hygiene Facilities**

Wherever there is exposure or possible exposure to heavy metals or silica dust at the bridge site, the Contractor shall, for State personnel: (1) furnish, clean, and replace protective work clothing and (2) provide access to hygiene facilities. The furnishing, cleaning, and replacement of protective work clothing and providing access to hygiene facilities shall conform to the provisions of subsections (g), "Protective work clothing and equipment," and (i), "Hygiene facilities and practices," of Section 1532.1, "Lead," of the Construction Safety Orders, and will be required for no more than 3 people.

The protective work clothing and access to hygiene facilities shall be provided during exposure or possible exposure to heavy metals or silica dust at the bridge site and during the application of the undercoats of paint.

Protective work clothing and hygiene facilities shall be inspected and approved by the Engineer before being used by State personnel.

The protective work clothing shall remain the property of the Contractor at the completion of the contract.

Full compensation for protective work clothing and access to hygiene facilities for State personnel shall be considered as included in the contract price paid for the item of work causing the existing paint system to be disturbed, and no additional compensation will be allowed therefor.

### **ABANDON CULVERT**

Existing culverts, where shown on the plans to be abandoned, shall be abandoned in place or, at the option of the Contractor, the culverts shall be removed and disposed of. Resulting openings into existing structures that are to remain in place shall be plugged with concrete conforming to the provisions in Section 90-10 "Minor Concrete," of the Standard Specifications. The concrete shall contain not less than 505 pounds of cementitious material per cubic yard.

Abandoning culverts in place shall conform to the following:

1. Culverts that intersect the side slopes shall be removed to a depth of not less than 3 feet measured normal to the plane of the finished side slope, before being abandoned.
2. Culverts 12 inches in diameter and larger, shall, at the Contractor's option, be backfilled with either sand, controlled low strength material or slurry cement backfill conforming to the provisions in Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications by any method acceptable to the Engineer that completely fills the pipe. Sand backfill material shall be clean, free draining, and free from roots and other deleterious substances.
3. The ends of culverts shall be securely closed by a 0.5-foot thick tight fitting plug or wall of commercial quality concrete.

Culverts shall not be abandoned until their use is no longer required. The Contractor shall notify the Engineer in advance of any intended culvert abandonment.

If the Contractor elects to remove and dispose of a culvert which is specified to be abandoned, as provided herein, backfill specified for the pipe will be measured and paid for in the same manner as if the culvert has been abandoned in place.

Backfill will be measured by the cubic yard determined from the dimensions of the culverts to be abandoned.

The contract price paid per cubic yard for sand backfill shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in backfilling culverts with sand, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Controlled low strength material and slurry cement backfill, if used at the Contractor's option, will be measured and paid for by the cubic yard as sand backfill.

Full compensation for concrete plugs, pipe removal, structure excavation, and backfill shall be considered as included in the contract price paid per linear foot for abandon culvert and no additional compensation will be allowed therefor.

#### **ABANDON INLET**

Existing pipe inlets and concrete drainage inlets, where shown on the plans to be abandoned, shall be abandoned.

The top portion of the inlets shall be removed to a depth of 3 feet below finished grade.

Removed frames and grates shall be disposed of.

Inlets shall not be abandoned until their use is no longer required. The Contractor shall notify the Engineer in advance of any intended inlet abandonment.

Holes shall be punched in the inlet bottom and the voids within the inlet shall be backfilled with sand. Sand backfill material shall be clean, free draining, and free from roots and other deleterious substances.

Full compensation for punching holes in bottom of inlets shall be considered as included in the contract unit price paid for abandon inlet and no additional compensation will be allowed therefor.

Sand backfill will be measured by the cubic yard determined from the dimensions of the inlets to be abandoned.

#### **REMOVE METAL BEAM GUARD RAILING**

Existing metal beam guard railing, where shown on the plans to be removed, shall be removed and disposed of.

Existing concrete anchors or steel foundation tubes shall be completely removed and disposed of. Full compensation for removing concrete anchors shall be considered as included in the contract price paid per linear foot for remove metal beam guard railing and no separate payment will be made therefor.

Full compensation for removing cable anchor assemblies, terminal anchor assemblies or steel foundation tubes shall be considered as included in the contract price paid per linear foot for remove metal beam guard railing and no separate payment will be made therefor.

#### **SALVAGE CONCRETE BARRIER (TYPE K) AND PORTABLE CONCRETE BARRIER (TYPE 60K)**

Existing concrete barrier (Type K) and portable concrete barrier (Type 60K), where shown on the plans to be salvaged, shall be removed and salvaged.

Salvaged concrete barrier (Type K) and portable concrete barrier (Type 60K) shall be hauled to 4425 East 3rd Street, Los Angeles, CA 90022 and stockpiled.

Existing connection plates, connection pins and cover plates shall be completely removed and disposed of. Full compensation for removing and disposing of connection plates, connection pins and cover plates shall be considered as included in the contract price paid per linear foot for salvage concrete barrier (Type K) and salvage portable concrete barrier (Type 60K), and no separate payment will be made therefor.

### **REMOVE SINGLE THRIE BEAM BARRIER(STEEL POST)**

Existing single thrie beam barrier(steel post), where shown on the plans to be removed, shall be removed and disposed of.

Existing concrete anchors or steel foundation tubes shall be completely removed and disposed of. Full compensation for removing concrete anchors shall be considered as included in the contract price paid per linear foot for remove single thrie beam barrier(steel post) and no separate payment will be made therefor.

Full compensation for removing cable anchor assemblies, terminal anchor assemblies or steel foundation tubes shall be considered as included in the contract price paid per linear foot for remove single thrie beam barrier(steel post) and no separate payment will be made therefor.

### **REMOVE CABLE RAILING**

Existing cable railing, where shown on the plans to be removed, shall be removed and disposed of.

Existing concrete anchors or steel foundation tubes shall be completely removed and disposed of. Full compensation for cutting off pipe post sleeves or other post anchorages on structure shall be considered as included in the contract price paid per linear foot for remove cable railing and no separate payment will be made therefor.

### **REMOVE SIGN STRUCTURE**

Existing sign structures, where shown on the plans to be removed, shall be removed and disposed of.

Overhead sign structure removal shall consist of removing posts, frames, portions of foundations, sign panels, walkways with safety railings, and sign lighting electrical equipment.

Bridge mounted sign structure removal shall consist of removing sign panels and frames, sign lighting electrical equipment, walkways with safety railings, structural braces and supports, and hardware.

A sign structure shall not be removed until the structure is no longer required for the direction of public traffic.

Concrete foundations may be abandoned in place, except that the top portion, including anchor bolts, reinforcing steel, and conduits shall be removed to a depth of not less than 3 feet below the adjacent finished grade. The resulting holes shall be backfilled and compacted with material equivalent to the surrounding material.

Electrical wiring shall be removed to the nearest pull box. Fuses within spliced connections in the pull box shall be removed and disposed of.

Electrical equipment, where shown on the plans, shall be salvaged.

### **REMOVE PAVEMENT MARKER**

Existing pavement markers, including underlying adhesive, when no longer required for traffic lane delineation as determined by the Engineer, shall be removed and disposed of.

### **REMOVE TRAFFIC STRIPE AND PAVEMENT MARKING**

This work includes removing existing traffic stripe and pavement marking at the locations shown on the plans.

Submit a lead compliance plan under Section 7-1.07, "Lead Compliance Plan," of the Standard Specifications.

Waste residue from removal of thermoplastic and painted traffic stripe and pavement marking is a non-hazardous waste residue and contains lead in average concentrations less than 1000 mg/kg total lead and 5 mg/L soluble lead. This waste residue does not contain heavy metals in concentrations that exceed thresholds established by the Health and Safety Code and 22 CA Code of Regs and is not regulated under the Federal Resource Conservation and Recovery Act (RCRA), 42 USC § 6901 et seq.

Removal of temporary traffic stripe will be paid for as remove traffic stripe.

### **REMOVE DRAINAGE FACILITY**

Existing culverts, inlets, and headwalls, where any portion of these structures is within 3 feet of the grading plane in excavation areas, or within one foot of original ground in embankment areas, or where shown on the plans to be removed, shall be completely removed and disposed of.

### **REMOVE ASPHALT CONCRETE DIKE**

Existing asphalt concrete dike, where shown on the plans to be removed, shall be removed.

Prior to removing the dike, the outside edge of the asphalt concrete to remain in place shall be cut on a neat line to a minimum depth of 0.17-foot.

The dike shall be removed in such a manner that the surfacing which is to remain in place is not damaged.

The dike may be buried in embankments in the same manner provided for burying concrete in embankments in Section 15-3, "Removing Concrete," of the Standard Specifications.

### **REMOVE ROADSIDE SIGN**

Existing roadside signs, at those locations shown on the plans to be removed, shall be removed and disposed of.

Existing roadside signs shall not be removed until replacement signs have been installed or until the existing signs are no longer required for the direction of public traffic, unless otherwise directed by the Engineer.

### **REMOVE CRASH CUSHION**

Existing crash cushions, at those locations shown on the plans to be removed, shall be removed and disposed of.

Existing crash cushions shall not be removed until permanent crash cushions are ready to be installed or until the existing crash cushions are no longer required for public safety.

Full compensation for remove crash cushion, including furnishing all labor, materials, tools, equipment, and incidentals for doing all the work for removal and disposal of crash cushion shall be considered as included in the contract unit price paid for remove crash cushion (sand filled) and no additional payment will be made therefor.

### **REMOVE CHANNELIZERS**

Existing channelizers, at those locations shown on the plans to be removed, shall be removed and disposed of.

When no longer required for the public safety as determined by the Engineer, existing channelizers and underlying adhesive shall be removed. Removed channelizers and adhesive shall become the property of the Contractor and shall be removed from the site of work.

Full compensation for remove channelizers, including furnishing all labor, materials, tools, equipment, and incidentals for doing all the work for removal and disposal of channelizers shall be considered as included in the contract unit price paid for remove channelizers and no additional payment will be made therefor.

### **REPLACE SIGN PANEL**

Existing sign panels, at the locations shown on the plans, shall be replaced in conformance with these special provisions.

Replace sign panel shall consist of installing reflex reflectors to the legend, borders, shields, and symbols of the sign panels shown on the plans.

Adhesive and reflex reflectors for replacing sign panels shall conform to the provisions under "Adhesive for Bonding Reflex Reflectors to Porcelain Enamel Traffic Signs" and "Reflex Reflectors" of these special provisions.

Sign panels to which the reflex reflectors are to be installed shall be cleaned by scrubbing with a cleanser on a moistened applicator. Excessive cleanser shall be removed by wiping with a clean dry cloth.

The spacing between the installed reflex reflectors shall be one-half the diameter of the reflector. The reflectors shall be centered on the stroke of the legend and border and shall be installed on shields and symbols so that the edge of the reflectors are flush with the edge of the shield or symbol. The spacing for letters and digits shall be adjusted so that reflex reflectors are installed at angle points and within 1/4 inch of the beginning and end of each letter or digit so that the sign message is well defined. The spacing for borders, symbols, and shields shall be adjusted so that reflex reflectors are not installed over rivets, bolt heads or seams between sign panels. The actual spacing for the reflex reflectors shall not vary more than 1/4 inch from the planned spacing.

The approximate number of reflex reflectors to be installed on legends, borders, shields, and symbols is shown on the plans.

Adhesive shall be applied to the sign panels or to the backs of the reflex reflectors at an approximate rate of 0.4-g per button, the exact rate to be determined by the Engineer, so that when the reflectors are pressed into position with a rotary motion, the adhesive will flow to form a thin uniform coating between the reflector and the sign panel with no air pockets or excessive bead. The reflex reflector shall not move after placing.

The adhesive shall not remain exposed on the sign panel or reflex reflector for longer than 2 minutes before the reflector is installed in place.

The quantity of replace sign panel (roadside sign) will be determined as units from actual count.

### **REMOVE CHAIN LINK FENCE**

Existing chain link fence, at the locations shown on the plans, shall be removed.

Fence removed in excess of that required for removing chain link fence shall be disposed of.

Full compensation for removing and disposing of excess fence shall be considered as included in the contract price paid per linear foot for remove chain link fence and no separate payment will be made therefor.

### **RELOCATE ROADSIDE SIGN**

Existing roadside signs shall be removed and relocated to the new locations shown on the plans.

Each roadside sign shall be installed at the new location on the same day that the sign is removed from its original location.

Two holes shall be drilled in each existing post as required to provide the breakaway feature shown on the plans.

## **ADJUST INLET**

Existing pipe inlets and concrete drainage inlets shall be adjusted as shown on the plans.

Concrete shall be minor concrete conforming to the provisions in Section 90-10, "Minor Concrete," of the Standard Specifications. The concrete shall contain not less than 590 pounds of cementitious material per cubic yard.

Where inlets are located in areas to be paved or surfaced, no individual structure shall be constructed to final grade until the paving or surfacing has been completed immediately adjacent to the structure.

## **ADJUST MANHOLE TO GRADE**

### **General**

#### **Summary**

This work includes lowering frame and cover before paving activities, then raising frame and cover to grade after paving.

Adjust frames and covers of existing manholes, junction structures or other facilities to grade under Section 15-2.05, "Reconstruction," of the Standard Specifications and details shown on the plans.

#### **Materials**

Concrete shall be minor concrete conforming to the provisions in Section 90-10, "Minor Concrete," of the Standard Specifications. The concrete shall contain not less than 590 pounds of cementitious material per cubic yard.

New manhole frame shall conform to the provisions in Section 75-1.02, "Miscellaneous Iron and Steel," of the Standard Specifications, except for payment. Existing manhole cover shall be reused in the work as shown on the plans.

Reinforcing steel for reinforcement and dowels shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications, except for payment.

#### **Construction**

Lower frames and covers of existing facilities before paving activities. Temporarily fill utility depressions with HMA (Type A) before opening the lane to public traffic.

Adjust frames and covers of existing facilities to grade as shown on the plans after completion of paving activities.

Drilling and bonding dowels shall conform to the details shown on the plans, the provisions in Section 51-1.13, "Bonding," of the Standard Specifications.

#### **Payment**

The contract unit price paid for adjust manhole to grade includes full compensation for furnishing all labor, materials (including miscellaneous iron and steel and reinforcing steel), tools, equipment, and incidentals, and for doing all the work involved in lowering and raising frames and cover of manholes to grade, complete in place, including concrete, drilling and bonding dowels, and HMA (Type A), as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## **OBLITERATE SURFACING**

Existing surfacing, when no longer required for the passage of public traffic, shall be obliterated at the locations shown on the plans.

Surfacing shall not be obliterated by the earth cover method.

Obliteration shall consist of rooting, plowing, pulverizing or scarifying the existing surfacing in conformance with the provisions in Section 15-2.02A, "Obliterating Roads and Detours," of the Standard Specifications.

## **REMOVE PORTLAND CEMENT CONCRETE PAVEMENT**

Removing portland cement concrete pavement shall conform to the provisions in Section 15-3, "Removing Concrete," of the Standard Specifications.

Where no joint exists in the pavement on the line at which concrete is to be removed, a straight, neat cut with a power driven saw shall be made along the line to a minimum depth of 2 inches before removing the concrete.

The quantities of portland cement concrete pavement removed will be measured and paid for by the cubic yard.

No deduction will be made from any excavation quantities for the quantity of portland cement concrete pavement removed.

Full compensation for removing bituminous or other overlying material and sawing joints at removal lines, as required, shall be considered as included in the contract price paid per cubic yard for remove concrete pavement and no additional compensation will be allowed therefor.

## **CAP INLET**

Existing pipe inlets and concrete drainage inlets, where shown on the plans to be capped, shall be capped and the bottoms of the inlets shall be rounded with portland cement concrete as shown on the plans.

Concrete shall be minor concrete conforming to the provisions in Section 90-10, "Minor Concrete," of the Standard Specifications. The concrete shall contain not less than 590 pounds of cementitious material per cubic yard.

Inlets shall be removed to a depth of at least one foot below the grading plane.

Concrete removal shall be performed without damage to portions of the inlet that are to remain in place. Damage to existing concrete, which is to remain in place, shall be repaired by the Contractor to a condition equal to that existing prior to the beginning of removal operations. The repair of existing concrete damaged by the Contractor's operations shall be at the Contractor's expense.

Existing reinforcement that is to be incorporated in the new work shall be protected from damage and shall be thoroughly cleaned of adhering material before being embedded in the new concrete.

The quantity of capping inlets will be determined as units from actual count.

The contract unit price paid for cap inlet shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in capping inlets, including removing portions of inlets, rounding bottoms of inlets, bar reinforcing steel, and structure excavation and structure backfill, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## **CAP RISER**

Pipe risers, where shown on the plans to be capped, shall be capped with checkered plate as shown on the plans.

Checkered plate covers shall conform to the provisions in "Miscellaneous Iron and Steel," of these special provisions, except for payment.

Portions of pipe risers shall be removed to the designed depth shown on the plans.

Pipe riser removal shall be performed without damage to portions of the riser that are to remain in place. Damage to existing riser, which is to remain in place, shall be repaired by the Contractor to a condition equal to that existing prior to the beginning of removal operations. The repair of existing riser damaged by the Contractor's operations shall be at the Contractor's expense.

Existing riser and pipe that is to be incorporated in the new work shall be protected from damage and shall be thoroughly cleaned of adhering material before being embedded in the new pavement.

The quantity of capping risers will be determined as units from actual count.

The contract unit price paid for cap riser shall include full compensation for furnishing all labor, materials (including checkered plate cover and miscellaneous iron and steel), tools, equipment, and incidentals, and for doing all the work involved in capping risers, including removing and disposing portions of corrugated steel pipe risers, , and structure excavation and structure backfill, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## **BRIDGE REMOVAL**

Removing bridges or portions of bridges shall conform to the provisions in Section 15-4, "Bridge Removal," of the Standard Specifications and these special provisions.

Bridge removal shall consist of removing the following existing bridge, including portions of retaining walls and footings as show on the plans.

Atlantic Boulevard Southbound On-Ramp  
(Bridge Number 53-1008K)

Bridge removal (portion) shall consist of removing portions of existing bridges or structures as briefly described and as shown on the plans at the locations as described below.

Location A  
Los Angeles River Bridge  
(Bridge Number 53-0828)

Remove portions of deck overhangs, existing bridge decks, drain inlets, drain pipes, concrete barriers, abutments, retaining walls, pier walls, concrete channel invert slab, and concrete channel lining and remove rivets in existing structural steel. Removing rivets shall conform to the provisions in "Remove Rivets" of these special provisions.

Location B  
Atlantic Boulevard Undercrossing  
(Bridge Number 53-1009)

Remove portions of concrete barriers, abutment walls and footings, and wingwalls.

Location C  
Route 710/5 Separation (East)  
(Bridge Number 53-0785R)

Remove portions of bridge deck, deck overhangs, concrete barriers and curbs, fascia girders, and wing walls.

Location D  
Route 710/5 Separation (West)  
(Bridge Number 53-0788L)

Remove portions of concrete barriers, concrete façades, wing walls, shear keys, and retaining walls.

Location E  
Olympic Boulevard Undercrossing  
(Bridge Number 53-1044)

Remove portions of concrete barriers, deck overhangs, raised median, abutments, and footings.

Location F  
Whittier Boulevard Undercrossing  
(Bridge Number 53-1150)

Remove portions of concrete barriers, deck overhangs and wingwalls.

Location G  
Floral Drive Undercrossing  
(Bridge Number 53-1155)

Remove portions of concrete barriers, deck overhangs, abutments, retaining walls, and footings.

The exposed top surfaces of existing abutments at Los Angeles River Bridge (Bridge Number 53-0828) with depressions or pockets resulting from the removal of concrete shall be finished to a Class 1 surface finish to the limits designated by the Engineer, as shown on the plans, and in conformance with the provisions in Section 15, "Existing Highway Facilities," Section 51, "Concrete Structures," and Section 95-1, "Epoxy," of the Standard Specifications and these special provisions.

Reinforcement exposed during the partial removal of the existing abutments shall be cut and removed to a depth of at least 1 inch. The resulting holes or depressions in the concrete shall be cleaned and filled with mortar.

The Contractor will be permitted to use other methods and filler materials than those listed in Section 51-1.18A, "Ordinary Surface Finish," of the Standard Specifications for filling depressions or pockets. The method of placement shall be determined by the Contractor. The material for filling depressed areas, and any bonding material between the existing concrete and filler material shall conform to the following requirements:

PROPERTY	REQUIREMENT	TEST METHOD
Abrasion resistance at 28 days	25 grams, max.	CA Test 550
Modulus of elasticity at 28 days	10.3 to 24.1 GPa	CA Test 551
Water soluble chlorides	500 mg/kg, max.	CA Test 422
Water soluble sulfates	2500 mg/kg, max.	CA Test 417

A minimum of one complete unit of all materials for repairing concrete surfaces shall be submitted to the Engineer for testing. The Contractor shall allow 45 days for the testing.

Prior to filling depressed surface areas, the concrete surfaces and exposed reinforcing steel shall be cleaned of all oil, soot, rust, and deleterious material by abrasive blasting.

When instructions for mixing, bonding, or curing are furnished by the filler or bonding material supplier, the instructions shall be followed except as modified by these provisions.

Within 14 days after placement, the patched surface area shall emit a ringing sound similar to the sound obtained for the adjacent sound concrete when tapped with a metal tool.

The Contractor shall provide access to allow the Engineer to reach the patched surface areas to determine limits for removal and the repaired areas for testing by tapping and measurement.

Full compensation for finishing the exposed top surfaces of the existing abutments is included in the contract lump sum price paid for bridge removal (portion), Location A, and no additional compensation will be allowed therefor.

Removed materials that are not to be salvaged or used in the reconstruction shall become the property of the Contractor and shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

The Contractor shall submit a complete bridge removal plan to the Engineer for each bridge listed above, detailing procedures, sequences, and all features required to perform the removal in a safe and controlled manner.

The bridge removal plan shall include, but not be limited to, the following:

- A. The removal sequence, including staging of removal operations.
- B. Equipment locations on the structure during removal operations.
- C. Temporary support shoring or temporary bracing.
- D. Locations where work is to be performed over traffic or utilities.
- E. Details, locations, and types of protective covers to be used.
- F. Measures to assure that people, property, utilities, and improvements will not be endangered.
- G. Details and measures for preventing material, equipment, and debris from falling onto public traffic.

When protective covers are required for removal of portions of a bridge or when superstructure removal work on bridges is involved, the Contractor shall submit working drawings with design calculations to the Engineer for the proposed bridge removal plan, and the bridge removal plan shall be prepared and signed by an engineer who is registered as a Civil Engineer in the State of California. The design calculations shall be adequate to demonstrate the stability of the structure during all stages of the removal operations. Calculations shall be provided for each stage of bridge removal and shall include dead and live load values assumed in the design of protective covers. At a minimum, a stage will be considered to be removal of the deck, the soffit, or the girders, in any span; or walls, bent caps, or columns at support locations.

Temporary support shoring, temporary bracing, and protective covers, as required, shall be designed and constructed in conformance with the provisions in Section 51-1.06, "Falsework," of the Standard Specifications and these special provisions.

The assumed horizontal load to be resisted by the temporary support shoring and temporary bracing, for removal operations only, shall be the sum of the actual horizontal loads due to equipment, construction sequence, or other causes and an allowance for wind, but in no case shall the assumed horizontal load to be resisted in any direction be less than 5 percent of the total dead load of the structure to be removed.

The bridge removal plan shall conform to the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The number of sets of drawings, design calculations, and unless otherwise specified in the following table, the time for reviewing bridge removal plans shall be the same as specified for falsework working drawings in Section 51-1.06A, "Falsework Design and Drawings," of the Standard Specifications.

The time to be provided for the Engineer's review of the bridge removal plans for removing specific structures, or portions thereof, shall be as follows:

Structure or Portion of Structure	Review Time - Weeks
Route 710/5 Separation (East) (Bridge Number 53-0785R)	5
Route 710/5 Separation (West) (Bridge Number 53-0788L)	5

The following additional requirements apply to the removal of bridges or portions of bridges that are over or adjacent to roadways that may be closed to public traffic for only brief periods of time:

- A. The closure of roadways to public traffic shall conform to the provisions in "Maintaining Traffic" of these special provisions.
- B. Prior to closing a roadway to traffic to accommodate bridge removal operations, the Contractor shall have all necessary workers, materials, and equipment at the site as needed to proceed with the removal work in an expeditious manner. While the roadway is closed to public traffic, work shall be pursued promptly and without interruption until the roadway is reopened to public traffic.
- C. Bridge removal operations shall be performed during periods of time that the roadway is closed to public traffic except as specified herein for preliminary work.
- D. Preliminary work shall be limited to operations that will not reduce the structural strength or stability of the bridge, or any element thereof, to a level that in the judgment of the Engineer would constitute a hazard to the public. This preliminary work shall also be limited to operations that cannot cause debris or any other material to fall onto the roadway. Protective covers may be used to perform preliminary work such as chipping or cutting the superstructure into segments, provided the covers are of sufficient strength to support all loads and are sufficiently tight to prevent dust and fine material from sifting down onto the traveled way. Protective covers shall extend at least 4 feet beyond the limit of the work underway. Bottom slabs of box girders may be considered to be protective covers for preliminary work performed on the top slab inside the limits of the exterior girders.

- E. Temporary support shoring and temporary bracing shall be used in conjunction with preliminary work when necessary to ensure the stability of the bridge.
- F. Temporary support shoring, temporary bracing, and protective covers shall not encroach closer than 8 feet horizontally from the edge or 15 feet vertically above any traffic lane or shoulder that is open to public traffic.
- G. During periods when the roadway is closed to public traffic, debris from bridge removal operations may be allowed to fall directly onto the lower roadway provided adequate protection is furnished for all highway facilities. The minimum protection for paved areas shall be a 2-foot-thick earthen pad or a 1-inch-thick steel plate placed over the area where debris can fall. Prior to reopening the roadway to public traffic, all debris, protective pads, and devices shall be removed and the roadway swept clean with wet power sweepers or equivalent methods.
- H. The removal operations shall be conducted in such a manner that the portion of the structure not yet removed remains in a stable condition at all times. For girder bridges, each girder shall be completely removed within a span before the removal of the adjacent girder is begun. For slab type bridges, removal operations within a span shall be performed along a front that roughly parallels the primary reinforcing steel.

For bridge removal work that requires the Contractor's registered engineer to prepare and sign the bridge removal plan, the Contractor's registered engineer shall be present at all times when bridge removal operations are in progress. The Contractor's registered engineer shall inspect the bridge removal operation and report in writing on a daily basis the progress of the operation and the status of the remaining structure. A copy of the daily report shall be available at the site of the work at all times. Should an unplanned event occur or the bridge operation deviate from the approved bridge removal plan, the Contractor's registered engineer shall submit immediately to the Engineer for approval the procedure of operation proposed to correct or remedy the occurrence.

### **REMOVE RIVETS**

Removing rivets shall conform to the requirements in Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

Attention is directed to Section 7-1.09, "Public Safety," and Section 7-1.12, "Responsibility for Damage," of the Standard Specifications.

Attention is directed to "Existing Paint Systems," of these special provisions regarding existing paint systems containing lead primer paints.

Furnishing and installing bolts at rivet removal locations, as shown on the plans, will be measured and paid for as specified in Section 55-4 "Measurement and Payment" of the Standard Specifications.

The Contractor shall submit to the Engineer for approval the proposed method for rivet removal in accordance with the requirements in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The Contractor shall demonstrate the proposed method for rivet removal using the equipment and procedures proposed for the work. Specific rivets to be removed for the demonstrations will be determined by the Engineer. The Engineer shall be notified a minimum of 24 hours prior to the Contractor performing any rivet removal demonstrations.

Rivet removal, other than removal for the demonstrations, will not be permitted until the removal method has been approved by the Engineer. The Engineer will notify the Contractor one week after the removal demonstration whether the proposed methods are approved or rejected.

In the event that the Engineer determines that rivet removal work is resulting in damage to the existing steel, the Contractor shall cease rivet removal operations until a new proposed method for rivet removal has been approved by the Engineer.

Rivets to be removed shall have their head chipped off and the shank driven, drilled, or cored out. Care shall be taken not to enlarge rivet holes or to damage remaining material. Burning will not be permitted. The Contractor shall demonstrate removal methods using heat to the Engineer. Heat resulting from any removal method shall not damage rivet holes or the surrounding materials.

Where existing rivets are removed, and the resulting holes require enlargement, the holes shall be enlarged by not more than one-sixteenth inch (1/16-inch) in diameter greater than the nominal bolt diameter shown on the plans. Holes shall be enlarged by reaming.

At locations where surrounding material has been damaged as a result of the Contractor's operations, and reaming of more than one-sixteenth inch (1/16-inch) in diameter greater than the nominal bolt diameter shown on the plans and the installation of an oversize bolt is required, the surrounding material shall be repaired and reamed and an oversize bolt shall be installed at the Contractor's expense.

At locations where rivet holes contain cracked, torn, or otherwise damaged material due to conditions other than the Contractor's operations, the Contractor shall ream the hole and install an oversized bolt. Additional reaming more than 1/16 inch in diameter than the nominal bolt diameter shown on the plans shall be done as directed by the Engineer. This additional reaming and the difference in actual cost between the bolt shown on the plans and the oversize bolt will be paid for as extra work as provided in Section 4-1.03 D of the Standard Specifications. Installing oversized bolts shall be at the Contractor's expense.

Inside surfaces of holes remaining after rivet removal or reaming shall be painted in conformance with the provisions in "Clean and Paint Structural Steel" of these special provisions.

Full compensation for remove rivets, including submitting the proposed method for rivet removal, demonstrating the proposed method, and enlarging rivet holes by not more than 1/16 inch in diameter greater than the nominal bolt diameter shown on the plans, is included in the contract lump sum price paid for bridge removal (portion), Location A, and no separate payment will be made therefor.

### **ACCESS OPENING, DECK**

Access openings in bridge decks shall consist of removing portions of existing bridge decks at the locations and to the dimensions shown on the plans.

Saw cuts to the depths shown on the plans shall be made around the perimeter of deck areas to be removed.

Prior to removal of concrete, saw cuts shall be made. The Contractor shall have all workers, materials and equipment on the site necessary to complete the removal of concrete or shall temporarily close the access opening.

Bar reinforcing steel shall be removed as shown on the plans.

Within a cell where work is to be performed, existing formwork and miscellaneous concrete that will interfere with the work shall be removed. In addition, when the work is to be done in a cell that adjoins a hinge, all existing forms and sharp projections in the cell between the hinge and 5 feet past the access opening shall be removed.

All materials removed shall become the property of the Contractor and shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Unless specified as an option, using soffit access openings in lieu of deck access openings will not be allowed.

Access openings through decks will be measured and paid for by the unit as access opening, deck. Openings to be paid for will be determined from actual count of the completed units in place.

The contract unit price paid for access opening, deck shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in making the deck opening, complete in place, including removing forms and miscellaneous concrete, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

### **CLEAN BRIDGE DECK**

This work includes abrasive blast cleaning the portland cement concrete bridge deck.

#### **General**

Traffic stripes, pavement markings, and pavement markers must be removed under "Remove Traffic Stripe and Pavement Marking" of these special provisions before cleaning the deck surface.

#### **Construction**

Abrasive blast clean the deck surface. Sweep the deck surface clean. Blow loose material from cracks using high-pressure air.

The deck surface must be dry when abrasive blast cleaning is performed. Laitance, surface contaminants, and foreign material must be removed from the bridge deck surface.

Remove dust and residue from abrasive blast cleaning using a vacuum attachment operating concurrently with blasting equipment when abrasive blast cleaning within 10 feet of public traffic.

If the deck surface becomes contaminated before placing methacrylate resin, abrasive blast clean the contaminated area and sweep the deck clean

Dispose of removed materials under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

#### **Measurement and Payment**

Clean bridge deck will be measured and paid for by the square foot of deck surface cleaned.

The contract price paid per square foot for clean bridge deck includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all work involved in cleaning the bridge deck, including removing contrast treatment except slurry or chip seal contrast treatment, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Removal of slurry or chip seal contrast treatment will be paid for as extra work as specified in Section 4-1.03D, "Extra Work," of the Standard Specifications.

## **REMOVE ASPHALT CONCRETE SURFACING**

This work includes removing existing asphalt concrete surfacing by cold milling to the existing portland cement concrete slab at bridge decks and approaches.

### **Construction**

Cold milling equipment must be able to:

1. Remove concrete a minimum depth of 1/4 inch
2. Provide a surface relief of at most 1/4 inch
3. Provide a 5/32-inch grade tolerance

Cold milling equipment must have the following features:

1. 3 or 4 riding tracks
2. An automatic grade control system with electronic averaging having 3 sensors on each side of the equipment
3. A conveyer system that leaves no debris on the bridge
4. A drum that operates in an up-milling direction
5. Bullet tooth tools with tungsten carbide steel cutting tips
6. A maximum tool spacing of 1/4 inch
7. A maximum operating weight of 66,000 pounds
8. A maximum track unit weight of 6,000 pounds per foot
9. New tooth tools at the start of the job

Provide personnel on each side of the milling drum to monitor cold milling activities. Maintain constant radio communication with the operator during milling activities.

Verify the depth of asphalt concrete surfacing every 50 feet at 1 location on each shoulder and in the traveled way.

Cut the outline of the asphalt concrete surfacing to be removed with a power saw to a depth of at least 2 inches before removing the surfacing. Asphalt surfacing must be removed without damaging the existing asphalt surfacing to remain.

Remove existing asphalt concrete surfacing by cold milling. At least 1/2 inch of asphalt concrete surfacing must remain after cold milling activities. Remove remaining 1/2 inch of asphalt surfacing using other means. The existing concrete slab must not be damaged during removal operations.

Dispose of removed materials under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

### **Measurement and Payment**

Remove asphalt concrete surfacing will be measured and paid for by the square foot.

The contract price paid per square foot for remove asphalt concrete surfacing includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in removing asphalt concrete surfacing as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## **REMOVE CONCRETE DECK SURFACE**

This work includes removing a portion of the portland cement concrete deck surface by high-pressure water jetting or cold milling.

### **Construction**

High-pressure water jet equipment must:

1. Have rotating jets
2. Be rated at 30,000 psi minimum

Water jetting residue must be removed after water jetting.

Cold milling equipment must be able to:

1. Remove concrete a minimum depth of 1/4 inch
2. Provide a surface relief of at most 1/4 inch
3. Provide a 5/32-inch grade tolerance

Cold milling equipment must have the following features:

1. 3 or 4 riding tracks
2. Automatic grade control system with electronic averaging having 3 sensors on each side of the equipment
3. Conveyer system that leaves no debris on the bridge
4. Drum that operates in an up-milling direction
5. Bullet tooth tools with tungsten carbide steel cutting tips
6. Maximum tool spacing of 1/4 inch
7. Maximum operating weight of 66,000 pounds
8. Maximum track unit weight of 6,000 pounds per foot
9. New tooth tools at the start of the job

Provide personnel on each side of the milling drum to monitor milling activities. Maintain constant radio communication with the operator during milling activities.

Sweep the deck surface. Blow the deck clean with high-pressure air. Remove 3/4 inch of deck surface.

Coarse aggregate remaining above the removal depth must be firmly embedded.

Dispose of removed materials under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

#### **Measurement and Payment**

Remove concrete deck surface will be measured by the square foot of concrete deck surface removed based on plan dimensions.

The contract price paid per square foot for remove concrete deck surface includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in removing concrete deck surface, except removing unsound concrete, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **PREPARE CONCRETE BRIDGE DECK SURFACE**

This work includes abrasive blast cleaning the concrete deck surface with steel shot and blowing the deck surface clean.

#### **Materials**

Steel shot must comply with SSPC-AB3. Recycled steel shot must comply with SSPC-AB2.

#### **Construction**

Abrasive blast clean the deck surface with steel shot. Remove all laitance, contaminants, and foreign material. Sweep the deck surface. Blow the deck surface clean using high-pressure air.

The deck must be dry when abrasive blast cleaning is performed. Removal of unsound concrete under "Remove Unsound Concrete" of these special provisions must be performed before abrasive blast cleaning.

Laitance, surface contaminants, chip or slurry seal contrast treatments, and foreign material must be removed from the concrete deck surface.

If the deck surface becomes contaminated before placing the overlay, abrasive blast clean the contaminated area and sweep the deck clean.

Residue from abrasive blasting must be removed by a vacuum attachment operating concurrently with blasting equipment when abrasive blasting within 10 feet of public traffic.

Dispose of removed materials under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

#### **Measurement and Payment**

Prepare concrete bridge deck surface will be measured and paid for by the square foot of deck surface prepared.

The contract price paid per square foot for prepare concrete bridge deck surface shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in preparing the concrete bridge deck surface, except removal of slurry or chip seal contrast treatment, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Removal of slurry or chip seal contrast treatment will be paid for as extra work as specified in Section 4-1.03D, "Extra Work," of the Standard Specifications.

## **REMOVE CONCRETE**

Concrete, where shown on the plans to be removed, shall be removed.

The pay quantities of concrete to be removed will be measured by the cubic yard, measured before and during removal operations. Concrete removed shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

## **REMOVE UNSOUND CONCRETE**

This work shall consist of the removal and disposal of unsound portland cement concrete, unsound epoxy concrete patches, and all asphalt concrete patches from the pedestals, decks, curbs, and railings of bridges. Unsound concrete shall be removed as shown on the plans and to the limits designated by the Engineer.

Unsound concrete is generally that concrete that emits a relatively dead or hollow sound when a chain is dragged over its surface or its surface is tapped with a metal tool. Concrete encasing corroded reinforcing steel beyond the limits identified by the sound may be considered unsound concrete. The Engineer will determine the concrete soundness.

Equipment and tools shall not be used to remove unsound concrete that, in the opinion of the Engineer, cause the removal of excess quantities of sound concrete along with the unsound concrete. Equipment shall be fitted with suitable traps, filters, drip pans, or other devices to prevent oil or other deleterious matter from being deposited on the deck.

After the removal of unsound concrete has been completed, any existing reinforcing steel that has been exposed shall be restored to position and blocked and tied in conformance with the provisions in Section 52, "Reinforcement," of the Standard Specifications.

Reinforcing steel that has been damaged and rendered useless by the Contractor's operations shall be repaired or replaced by the Contractor at the Contractor's expense.

Removing unsound concrete at all locations other than the Los Angeles River Bridge (Bridge Number 53-0828) will be paid for at the contract price per cubic foot for remove unsound concrete.

When the voids created by the removal of unsound concrete are filled with rapid setting concrete patches, the pay quantities for remove unsound concrete, in cubic feet, shall be the same as the pay quantities in cubic feet determined for rapid setting concrete (patch) as specified in "Rapid Setting Concrete Patches" of these special provisions. No deduction in pay quantities for remove unsound concrete will be made for concrete used to fill spalls that existed prior to the start of the work.

Pay quantities determined by the methods of measurement specified in this section will not necessarily be equal to the quantities computed from the actual dimensions of the concrete actually removed. No allowance will be made in the event that the pay quantities do not equal the volume of concrete actually removed.

The contract price paid per cubic foot for remove unsound concrete shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in removing unsound concrete in conformance with the details shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for removing unsound concrete at the Los Angeles River Bridge (Bridge Number 53-0828) is included in the contract price paid per cubic yard for structural concrete, bridge, and no separate payment will be made therefor.

Where no joint exists between concrete to be removed and concrete to remain in place, the concrete shall be cut on a neat line to a minimum depth of 0.17-foot with a power driven saw before the concrete is removed.

Where concrete has been removed outside the roadway prism, the backfilled areas shall be graded to drain and blend in with the surrounding terrain.

Concrete to be removed which has portions of the same structure both above and below ground will be considered as concrete above ground for compensation.

## **10-1.36 CLEARING AND GRUBBING**

Clearing and grubbing shall conform to the provisions in Section 16, "Clearing and Grubbing," of the Standard Specifications and these special provisions.

Vegetation shall be cleared and grubbed only within the excavation and embankment slope lines.

## **10-1.37 DUST PALLIATIVE**

Furnishing and applying dust palliative shall conform to the provisions in Section 18, "Dust Palliative," of the Standard Specifications.

**10-1.38 EARTHWORK**

Earthwork shall conform to the provisions in Section 19, "Earthwork," of the Standard Specifications and these special provisions.

The material for the filter blanket under the concrete channel invert slab at Los Angeles River Bridge (Bridge Number 53-0828) shall conform to the provisions in Section 19-3.025B, "Sand Bedding," of the Standard Specifications.

The material for the drain blanket under the concrete channel slab at Los Angeles River Bridge (Bridge Number 53-0828) shall be 1" crushed rock conforming to the provisions in Section 200-1.2, "Crushed Rock and Rock Dust," of the 2009 Edition of The "Greenbook," Standard Specifications for Public Works Construction.

When a layer of specified material is not to be placed on the basement material, the finished grading plane shall not vary more than 0.10-foot above or below the grade established by the Engineer. The requirements for obtaining a relative compaction of 95 percent, as provided in the first 2 paragraphs in Section 19-5.03, "Relative Compaction (95 Percent)," of the Standard Specifications shall not apply when a layer of specified material is not to be placed on the basement material.

Surplus excavated material not designated as hazardous waste due to aerially deposited lead shall become the property of the Contractor and shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Where a portion of the existing surfacing is to be removed, the outline of the area to be removed shall be cut on a neat line with a power-driven saw to a minimum depth of 0.17-foot before removing the surfacing. Full compensation for cutting the existing surfacing shall be considered as included in the contract price paid per cubic yard for roadway excavation and no additional compensation will be allowed therefor.

Reinforcement or metal attached to reinforced concrete rubble placed in embankments shall not protrude above the grading plane. Prior to placement within 2 feet below the grading plane of embankments, reinforcement or metal shall be trimmed to no greater than 3/4 inch from the face of reinforced concrete rubble. Full compensation for trimming reinforcement or metal shall be considered as included in the contract prices paid per cubic yard for the types of excavation shown in the Engineer's estimate, or the contract prices paid for furnishing and placing imported borrow or embankment material, as the case may be, and no additional compensation will be allowed therefor.

At the option of the Contractor, slurry cement backfill conforming to the provisions in Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications may be used as structure backfill for pipe culverts, including aluminum and aluminum coated pipe culverts.

The "0.5-foot" dimensions in the fifth paragraph of Section 19-3.08, "Payment," of the Standard Specifications are increased to "one foot" on this project.

Settlement periods are required for the bridge approach embankments at the bridges listed in the following table.

At the bridge bents listed in the following table, excavation for the footings, drilling holes for cast-in-place piles, or driving the foundation piles at each location shall not be done until the expiration of the settlement period for the embankment at the adjacent abutment of the same structure or an adjacent structure.

Surcharge embankments shall be constructed at or above the grading plane where listed in the following table:

Bridge Name or Number	Abutment Number	Bent Number	Surcharge Height (feet)	Settlement Period (days)
Los Angeles River Bridge (Br. Num. 53-0828)	1 and 5	2 and 4	0.0*	30
Atlantic Blvd. On-Ramp UC (Br. Num. 53-3067)	1 and 2	--	0.0*	30
Atlantic Blvd. UC (Br. Num. 53-1009)	1 and 3	2	0.0*	30
Route 710/5 Separation (East) (Br. Num. 53-0785R)	1 and 9	2 and 8	0.0*	30
Route 710/5 Separation (West) (Br. Num. 53-0788L)	1 and 10	2 and 9	0.0*	30
Olympic Blvd. UC (Br. Num. 53-1044)	1 and 2	--	0.0*	30

\* At this location, the surcharge embankment shall be constructed by extending the grading plane (GP) in the "Elevation" view of the "Bridge Embankment Surcharge" detail of Standard Plan A62B horizontally to the centerline of abutment.

The duration of the required settlement period at each location will be determined by the Engineer. The estimated duration of the settlement periods are listed in the tables of settlement data. The Engineer may order an increase or decrease in any settlement period. An ordered increase or decrease in any settlement period will result in an increase or decrease in the number of contract working days if the settlement period involved is considered to be the current controlling operation in conformance with the provisions in Section 8-1.06, "Time of Completion," of the Standard Specifications. Adjustments of contract time due to increases or decreases in settlement periods will be made by contract change order.

The removal of surplus embankment material placed as a surcharge embankment, including material removed to conform to the finished slope lines shown on the plans, will be paid for at the contract price per cubic yard for roadway excavation.

At the locations and to the limits shown on the plans, material below the bottom of retaining wall footings shall be removed and replaced with Class 3 aggregate base material in conformance with the placing and compacting requirements for structure backfill. The relative compaction shall be not less than 95 percent. Removal of the material will be measured and paid for by the cubic yard as structure excavation (retaining wall) and furnishing, placing, and compacting the replacement material will be measured and paid for by the cubic yard as structure backfill (retaining wall).

At Retaining Wall 1271 and if the Contractor elects to use the "Weep Hole and Geocomposite Drain" alternative where permitted on the plans at other locations, the geocomposite drain shall conform to the details shown on the plans and the following:

- A. Geocomposite wall drain shall consist of a manufactured core not less than 0.25 inch thick nor more than 2 inches thick with one or both sides covered with a layer of filter fabric that will provide a drainage void. The drain shall produce a flow rate through the drainage void of at least 2.0 gallons per minute per foot of width at a hydraulic gradient of 1.0 and a minimum externally applied pressure of 3,500 psf.
- B. A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications shall be furnished for the geocomposite drain certifying that the drain produces the required flow rate and complies with these special provisions. The Certificate of Compliance shall be accompanied by a flow capability graph for the geocomposite drain showing flow rates for externally applied pressures and hydraulic gradients. The flow capability graph shall be stamped with the verification of an independent testing laboratory.
- C. Filter fabric for geocomposite wall drain shall conform to the provisions in Section 88-1.02, "Filtration," of the Standard Specifications. Filter fabric shall be Class A.
- D. The manufactured core shall be either a preformed grid of embossed plastic, a mat of random shapes of plastic fibers, a drainage net consisting of a uniform pattern of polymeric strands forming 2 sets of continuous flow channels, or a system of plastic pillars and interconnections forming a semirigid mat.
- E. The core material and filter fabric shall be capable of maintaining the drainage void for the entire height of geocomposite drain. Filter fabric shall be integrally bonded to the side of the core material with the drainage void. Core material manufactured from impermeable plastic sheeting having nonconnecting corrugations shall be placed with the corrugations approximately perpendicular to the drainage collection system.
- F. The geocomposite drain shall be installed with the drainage void and the filter fabric facing the embankment. The fabric facing the embankment side shall overlap a minimum of 3 inches at all joints and wrap around the exterior edges a minimum of 3 inches beyond the exterior edge. If additional fabric is needed to provide overlap at joints and wrap-around at edges, the added fabric shall overlap the fabric on the geocomposite drain at least 6 inches and be attached thereto.
- G. Should the fabric on the geocomposite drain be torn or punctured, the damaged section shall be replaced completely or repaired by placing a piece of fabric that is large enough to cover the damaged area and provide a minimum 6-inch overlap.
- H. Plastic pipe shall conform to the provisions for edge drain pipe and edge drain outlets in Section 68-3, "Edge Drains," of the Standard Specifications.
- I. Treated permeable base to be placed around the slotted plastic pipe at the bottom of the geocomposite drain shall be cement treated permeable base conforming to the provisions for cement treated permeable base in Section 29, "Treated Permeable Bases," of the Standard Specifications and these special provisions.
- J. The treated permeable base shall be enclosed with a high density polyethylene sheet or PVC geomembrane, not less than 10 mils thick, that is bonded with a suitable adhesive to the concrete and geocomposite drain. Surfaces to receive the polyethylene sheet shall be cleaned before applying the adhesive. The treated permeable base shall be compacted with a vibrating shoe type compactor.

## **SOLDIER PILE WALL EARTHWORK**

### **General**

The Contractor shall submit to the Engineer working drawings, including design calculations, and a construction sequence for the proposed method of soldier pile wall construction for the site in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The drawings and calculations shall be signed by an engineer who is registered as a Civil Engineer in the State of California. One set of the drawings and construction sequence, and one copy of the design calculations, shall be furnished to the Engineer. The working drawings and construction sequence shall include, but not be limited to, defining order of work, traffic control, method of installation of soldier piles, method of placing lagging, limits of structure excavation lifts, and type of drilling and excavation equipment to be used. The Contractor shall allow 7 days after complete drawings and support data are submitted for the review and approval of the proposed method of soldier pile wall construction.

### **Structure Excavation (Soldier Pile Wall)**

Excavation and construction of the soldier pile wall shall proceed in lifts from the top down.

Care shall be taken in performing structure excavation (soldier pile wall) for placement of lagging such that a minimal void behind the lagging is required to be backfilled.

At the end of the work shift, lagging shall be in place the full height of the exposed excavation face.

### **Structure Backfill (Soldier Pile Wall)**

Material for structure backfill behind lagging shall conform to the provisions in Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications. Structure backfill behind lagging shall be compacted by hand tamping, mechanical compaction, or other means approved by the Engineer.

Structure backfill in fill areas behind the lagging shall be keyed into the existing or excavated back slope.

### **Lean Concrete Backfill**

Lean concrete backfill shall conform to the provisions for slurry cement backfill in Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications, except that aggregate shall be sand suitable for making commercial quality concrete.

Lean concrete backfill in the portions of the drilled holes occupied by lagging and in front of the soldier pile flanges shall be removed as necessary to install lagging.

### **Concrete Backfill**

Concrete backfill of the types listed in the engineer's estimate encasing the steel soldier piles below the lagging shall contain not less than 590 pounds of cementitious material per cubic yard and shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications and these special provisions.

Pervious backfill material placed within the limits of payment for bridges will be measured and paid for as structure backfill (bridge).

If structure excavation or structure backfill for bridges is not otherwise designated by type and payment for the structure excavation or structure backfill has not otherwise been provided for in the Standard Specifications or these special provisions, the structure excavation or structure backfill will be measured and paid for as structure excavation (bridge) or structure backfill (bridge), respectively.

Lean concrete backfill will be measured and paid for by the cubic yard as lean concrete backfill in the same manner specified for structure backfill in Section 19-3.07, "Measurement," and Section 19-3.08, "Payment," of the Standard Specifications.

Concrete backfill encasing steel soldier piles below the lagging will be measured and paid for by the cubic yard as concrete backfill of the types listed in the Engineer's Estimate in the same manner specified for structure backfill in Section 19-3.07, "Measurement," and Section 19-3.08, "Payment," of the Standard Specifications.

Full compensation for removing lean concrete backfill shall be considered as included in the contract price paid per cubic yard for structure excavation (soldier pile wall) and no additional compensation will be allowed therefor.

Full compensation for working drawings and construction sequence, and temporary supports and shoring, if required, for soldier pile wall construction shall be considered as included in the contract price paid per cubic yard for structure excavation (soldier pile wall) and no additional compensation will be allowed therefor.

Full compensation for geocomposite drain, including filter fabric and plastic pipe, shall be considered as included in the contract price paid per cubic yard for structure backfill (soldier pile wall) and no additional compensation will be allowed therefor.

Providing materials for and placing of the filter blanket and the drain blanket are paid for as structural backfill (bridge).

### **10-1.39 CONTROLLED LOW STRENGTH MATERIAL**

Controlled low strength material shall consist of a workable mixture of aggregate, cementitious materials, and water and shall conform to the provisions for slurry cement backfill in Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications and these special provisions.

At the option of the Contractor, controlled low strength material may be used as structure backfill for pipe culverts, except that controlled low strength material shall not be used as structure backfill for culverts having a diameter or span greater than 20 feet.

When controlled low strength material is used for structure backfill, the width of the excavation shown on the plans may be reduced so that the clear distance between the outside of the pipe and the side of the excavation, on each side of the pipe, is a minimum of 12 inches. This minimum may be reduced to 6 inches when the height of cover is less than or equal to 20 feet or the pipe diameter or span is less than 42 inches.

Controlled low strength material in new construction shall not be permanently placed higher than the basement soil. For trenches in existing pavements, permanent placement shall be no higher than the bottom of the existing pavement permeable drainage layer. If a drainage layer does not exist, permanent placement in existing pavements shall be no higher than one inch below the bottom of the existing asphalt concrete surfacing or no higher than the top of base below the existing portland cement concrete pavement. The minimum height that controlled low strength material shall be placed, relative to the culvert invert, is 0.5 diameter or 0.5 height for rigid culverts and 0.7 diameter or 0.7 height for flexible culverts.

When controlled low strength material is proposed for use, the Contractor shall submit a mix design and test data to the Engineer for approval prior to excavating the trench for which controlled low strength material is proposed for use. The test data and mix design shall provide for the following:

- A. A 28-day compressive strength between 50 pounds per square inch and 100 pounds per square inch for pipe culverts having a height of cover of 20 feet or less and a minimum 28-day compressive strength of 100 pounds per square inch for pipe culverts having a height of cover greater than 20 feet. Compressive strength shall be determined in conformance with the requirements in ASTM Designation: D 4832.
- B. Cement shall be any type of portland cement conforming to the requirements in ASTM Designation: C 150; or any type of blended hydraulic cement conforming to the requirements in ASTM Designation: C 595M or the physical requirements in ASTM Designation: C 1157M. Testing of cement will not be required.
- C. Admixtures may be used in conformance with the provisions in Section 90-4, "Admixtures," of the Standard Specifications. Chemical admixtures containing chlorides as Cl in excess of one percent by weight of admixture, as determined in conformance with the requirements of California Test 415, shall not be used. If an air-entraining admixture is used, the maximum air content shall be limited to 20 percent. Mineral admixtures shall be used at the Contractor's option.

Materials for controlled low strength material shall be thoroughly machine-mixed in a pugmill, rotary drum or other approved mixer. Mixing shall continue until the cementitious material and water are thoroughly dispersed throughout the material. Controlled low strength material shall be placed in the work within 3 hours after introduction of the cement to the aggregates.

When controlled low strength material is to be placed within the traveled way or otherwise to be covered by paving or embankment materials, the material shall achieve a maximum indentation diameter of 3 inches prior to covering and opening to public traffic. Penetration resistance shall be measured in conformance with the requirements in ASTM Designation: D 6024.

Controlled low strength material used as structure backfill for pipe culverts will be considered structure backfill for compensation purposes.

### **10-1.40 MATERIAL CONTAINING HAZARDOUS WASTE CONCENTRATIONS OF AERIALY DEPOSITED LEAD**

Earthwork involving material containing aerially deposited lead shall conform to the provisions in Section 19, "Earthwork," of the Standard Specifications and these special provisions.

Attention is directed to "Aerially Deposited Lead" of these special provisions.

Type Y-1 material contains aerially deposited lead in average concentrations of 1.5 mg/L or less extractable lead (based on a modified waste extraction test using deionized water as the extractant) and 1411 mg/kg or less total lead. Type Y-1 material exists as shown on the plans. This material shall be placed as shown on the plans, unless otherwise directed by the Engineer, and covered with a minimum 1-foot layer of nonhazardous soil or pavement. This material is hazardous waste regulated by the State of California that may be reused as permitted under the Variance of the California Department of Toxic Substances Control (DTSC) provided that the lead contaminated soil is placed a minimum of 5 feet above the maximum water table elevation and covered with at least one foot of nonhazardous soil. Temporary surplus material may be generated on this project due to the requirements of stage construction. Temporary surplus material shall not be transported outside the

State right of way. In order to conform to the requirements of these provisions it may be necessary to stockpile material for subsequent stages, to construct some embankments out of stage, or to handle temporary surplus material more than once.

Type Z-2 material contains aerially deposited lead in average concentrations (using the 95 percent Upper Confidence Limit) greater than or equal to 1000 mg/kg total lead; greater than or equal to 5.0 mg/L soluble lead (as tested using the California Waste Extraction Test) and the material is surplus; or greater than 3397 mg/kg total lead. Type Z-2 material exists, as shown on the plans. This material is hazardous waste regulated by the State of California and shall be transported to and disposed of at a Class I Disposal Site. Material excavated from these areas shall be transported by a hazardous waste transporter registered with the DTSC using the required procedures for creating a manifest for the material. The vehicles used to transport the hazardous material shall conform to the current certifications of compliance of the DTSC.

### **LEAD COMPLIANCE PLAN**

Submit a lead compliance plan under Section 7-1.07, "Lead Compliance Plan," of the Standard Specifications.

The Lead Compliance Plan shall include perimeter air monitoring incorporating upwind and downwind locations as shown on the plans or as approved by the Engineer. Monitoring shall be by personal air samplers using National Institute of Safety and Health Method 7082. Sampling shall achieve a detection limit of 0.05  $\mu\text{g}/\text{m}^3$  of air per day. Daily monitoring shall take place while the Contractor clears and grubs and performs earthwork operations. A single representative daily sample shall be analyzed for lead. Results shall be analyzed and provided to the Engineer within 24 hours. Average lead concentrations shall not exceed 1.5  $\mu\text{g}/\text{m}^3$  of air per day and 0.15  $\mu\text{g}/\text{m}^3$  per day on a rolling 90-day basis. Average daily concentrations shall be calculated based on monitoring to date, and projection based on those monitoring trends for the next 90 days or to the end of work subject to the Lead Compliance Plan if less than the specified averaging period. If concentrations exceed these levels the Contractor shall stop work and modify the work to prevent release of lead. Monitoring shall be done under the direction of, and the data shall be reviewed by and signed by a Certified Industrial Hygienist.

### **EXCAVATION AND TRANSPORTATION PLAN**

Within 15 days after approval of the contract, the Contractor shall submit 3 copies of an Excavation and Transportation Plan to the Engineer. The Engineer will have 10 days to review the plan. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit the plan within 7 days of receipt of the Engineer's comments. The Engineer will have 7 days to review the revisions. Upon the Engineer's approval of the plan, 3 additional copies incorporating the required changes shall be submitted to the Engineer. Minor changes to or clarifications of the initial submittal may be made and attached as amendments to the Excavation and Transportation Plan. In order to allow construction to proceed, the Engineer may conditionally approve the plan while minor revisions or amendments are being completed.

The Contractor shall prepare the written, project specific Excavation and Transportation Plan establishing the procedures the Contractor will use to comply with requirements for excavating, stockpiling, transporting, and placing (or disposing) of material containing aerially deposited lead. The plan shall conform to the regulations of the DTSC and Cal-OSHA. The sampling and analysis portions of the Excavation and Transportation Plan shall meet the requirements for the design and development of the sampling plan, statistical analysis, and reporting of test results contained in USEPA, SW 846, "Test Methods for Evaluating Solid Waste," Volume II: Field Manual Physical/Chemical, Chapter Nine, Section 9.1. The plan shall contain, but not be limited to the following elements:

- A. Excavation schedule (by location and date),
- B. Temporary locations of stockpiled material,
- C. Sampling and analysis plans for areas after removal of a stockpile,
  - 1. Location and number of samples,
  - 2. Analytical laboratory,
- D. Survey methods for Type Y-1 material burial locations,
- E. Sampling and analysis plan for soil cover,
- F. Dust control measures,
- G. Air monitoring,
  - 1. Location and type of equipment,
  - 2. Sampling frequency,
  - 3. Analytical laboratory,
- H. Transportation equipment and routes,
- I. Method for preventing spills and tracking material onto public roads,
- J. Truck waiting and staging areas,

- K. Site for disposal of hazardous waste,
- L. Example of Bill of Lading to be carried by trucks transporting Type Y-1 , material. The Bill of Lading shall contain: US DOT description including shipping name, hazard class, and ID number; handling codes; quantity of material; and volume of material. Copies of the bills of lading shall be provided to the Engineer upon placement of Type Y-1 material in its final location. Trucks carrying Type Y-1 material shall not leave the highway right of way.
- M. Spill Contingency Plan for material containing aurally deposited lead.

### **DUST CONTROL**

Excavation, transportation, placement, and handling of material containing aurally deposited lead shall result in no visible dust migration. The Contractor shall have a water truck or tank on the job site at all times while clearing and grubbing and performing earthwork operations in work areas containing aurally deposited lead.

### **STOCKPILING**

Stockpiles of material containing aurally deposited lead shall not be placed where affected by surface run-on or run-off. Stockpiles shall be covered with plastic sheeting 13 mils minimum thickness or one foot of nonhazardous material. Stockpiles shall not be placed in environmentally sensitive areas. Stockpiled material shall not enter storm drains, inlets, or waters of the State.

### **SURVEYING TYPE Y-1 or Y-2 MATERIAL BURIAL LOCATIONS**

Survey the location of the bottom and top perimeters of each area where you bury Type Y-1 material (burial locations). The survey must be performed by or under the direction of either:

- (1) A land surveyor licensed under Chapter 15 of the Business and Professions Code (commencing with Section 8700),
- or
- (2) A civil engineer licensed prior to January 1, 1982 under Chapter 7 of the Business and Professions Code (commencing with Section 6700).

Survey ten points to determine each burial location horizontally and vertically within the specified accuracies and to create closed polygons of the perimeters of the bottom and top of the burial location. If ten points are not sufficient to define the polygon add additional points until the polygon is defined. Establish the position of the bottom and top perimeters before placing subsequent layers of material that obstruct the location.

Report each burial location in California State Plane Coordinates in US Survey feet within the appropriate zone of the California Coordinate System of 1983 (CCS83) and in latitude and longitude. Horizontal positions shall be referenced to CCS83 (epoch 2007.00 or later NGS or CSRC published epoch) to an accuracy of 3 feet horizontally. The elevation of points identifying the burial location shall locate the bottom and top of Type Y-1 material to an accuracy of 1 foot vertically. Elevations of the bottom and top of Type Y-1 material shall be referenced to North American Vertical Datum of 1988 (NAVD88) . Report accuracy of spatial data in US Survey feet under FGDC-STD-007.1-1998.

Within five business days of completing placement of Type Y-1 material at a burial location, submit a report for that burial location, including form CEM 1901 and electronic geospatial vector data shapefiles of the top and bottom perimeters of the burial location to the Engineer and to the following email address:

ADL@dot.ca.gov

The Engineer will notify you of acceptance or rejection of the burial location report within five business days of receipt. If the report is rejected, you have five business days to submit a corrected report.

### **MATERIAL TRANSPORTATION**

Prior to traveling on public roads, loose and extraneous material shall be removed from surfaces outside the cargo areas of the transporting vehicles and the cargo shall be covered with tarpaulins or other cover, as outlined in the approved Excavation and Transportation Plan. The Contractor shall be responsible for costs due to spillage of material containing lead during transport.

The Department will not consider the Contractor a generator of the hazardous material, and the Contractor will not be obligated for further cleanup, removal, or remedial action for such material handled or disposed of in conformance with the requirements specified in these special provisions and the appropriate State and Federal laws and regulations and county and municipal ordinances and regulations regarding hazardous waste.

## **DISPOSAL**

Surplus material for which the lead content is not known shall be analyzed for aurally deposited lead by the Contractor prior to removing the material from within the project limits. The Contractor shall submit a sampling and analysis plan and the name of the analytical laboratory to the Engineer at least 15 days prior to beginning sampling or analysis. The Contractor shall use a laboratory certified by the California Department of Health Services. Sampling shall be at a minimum rate of one sample for each 200 cubic yards of surplus material and tested for lead using EPA Method 6010 or 7000 series.

Materials containing aurally deposited lead shall be disposed of within California. The disposal site shall be operating under a permit issued by the appropriate California Environmental Protection Agency board or department.

The Engineer will obtain the Environmental Protection Agency Generator Identification Number for hazardous waste disposal. The Engineer will sign all hazardous waste manifests. The Contractor shall notify the Engineer 5 business days before the manifests are to be signed.

Sampling, analyzing, transporting, and disposing of material containing aurally deposited lead excavated outside the pay limits of excavation will be at the Contractor's expense.

## **MEASUREMENT AND PAYMENT**

Quantities of roadway excavation (aurally deposited lead) and structure excavation (aurally deposited lead), of the types shown in the Engineer's Estimate, will be measured and paid for in the same manner specified for roadway excavation and structure excavation, respectively, in Section 19, "Earthwork," of the Standard Specifications.

Full compensation for preparing an approved Excavation and Transportation Plan, transporting material containing aurally deposited lead reused in the work from location to location, and transporting and disposing of material containing aurally deposited lead shall be considered as included in the contract prices paid per cubic yard for the items of roadway excavation (aurally deposited lead) and structure excavation (aurally deposited lead) of the types involved, and no additional compensation will be allowed therefor.

No payment for stockpiling of material containing aurally deposited lead will be made, unless the stockpiling is ordered by the Engineer.

Sampling, analyses, and reporting of results for surplus material not previously sampled will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

The contract lump sum price paid for ADL Burial Location Report includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in collecting and reporting the data as specified in these special provisions, and as directed by the Engineer.

### **10-1.41 MOVE-IN/MOVE-OUT (EROSION CONTROL)**

Move-in/move-out (Erosion Control) shall include moving onto the project when an area is ready to receive erosion control as determined by the Engineer, setting up all required personnel and equipment for the application of erosion control materials and moving out all personnel and equipment when erosion control in that area is completed.

Quantities of move-in/move-out (Erosion Control) will be determined as units from actual count as determined by the Engineer. For measurement purposes, a move-in followed by a move-out will be considered as one unit.

The contract unit price paid for move-in/move-out (Erosion Control) shall include full compensation for furnishing all labor, materials (excluding erosion control materials), tools, equipment, and incidentals and for doing all the work involved in moving in and removing from the project all personnel and equipment necessary for application of erosion control Hydroseed, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

No adjustment of compensation will be made for any increase or decrease in the quantities of move-in/move-out (Erosion Control) required, regardless of the reason for the increase or decrease. The provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications shall not apply to the item of move-in/move-out (Erosion Control).

### **10-1.42 EROSION CONTROL (HYDROSEED)**

#### **GENERAL**

##### **Summary**

This work includes removing and disposing of weeds and applying erosion control materials including seed, and fiber to erosion control (Hydroseed) areas shown on the plans.

Comply with Section 20-3, "Erosion Control," of the Standard Specifications.

Comply with "Move-In/Move-Out (Erosion Control)" of these special provisions.

If notified by the Engineer that an area is ready to receive erosion control materials, start erosion control (Hydroseed) work within 5 business days of the Engineer's notification to perform the work.

The Engineer will designate the ground location of all erosion control (Hydroseed) areas in increments of one acre or smaller by directing the placing of stakes or other suitable markers. Furnish all tools, labor, materials, and transportation required to adequately indicate the various erosion control (Hydroseed) locations.

**MATERIALS**

**Seed**

Seed not required to be labeled under the California Food and Agricultural Code must be tested for purity and germination by a seed laboratory certified by the Association of Official Seed Analysts or by a seed technologist certified by the Society of Commercial Seed Technologists. Measure and mix individual seed species in the presence of the Engineer.

Seed must contain at most 1.0 percent total weed seed by weight.

Deliver seed to the job site in unopened separate containers with the seed tag attached. Containers without a seed tag attached are not accepted. The Engineer takes a sample of approximately one ounce or 0.25 cup of seed for each seed lot greater than 2 pounds.

Seed must comply with the following:

Seed		
Botanical Name (Common Name)	Percent Germination (Minimum)	Pounds Pure Live Seed Per Acre (Slope Measurement)
Lolium Multiflorum (Annual Rye Grass)	40	40
Nassella Pulchra (Purple Needlegrass)	40	7
Hordeum Californicum (Common Barley)	40	17
	Total	64

**Seed Sampling Supplies**

At the time of seed sampling, provide the Engineer a glassine lined bag and custody seal tag for each seed lot sample.

**Fiber**

Fiber must be:

1. Wood
2. Cellulose
3. Alternate
4. A combination of Wood, Cellulose, or Alternate

Fiber must comply with the following:

1. Free from lead paint, printing ink, varnish, petroleum products, seed germination inhibitors, or chlorine bleach
2. Free from synthetic or plastic materials
3. At most 7 percent ash

Wood Fiber must comply with the following:

1. Long strand, whole wood fibers, thermo-mechanically processed from clean, whole wood chips
2. Not made from sawdust, cardboard, paper, or paper byproducts
3. At least 25 percent of fibers 3/8 inch long
4. At least 40 percent held on a No. 25 sieve

Cellulose Fiber must comply with the following:

1. Made from natural or recycled pulp fiber, such as wood chips, sawdust, newsprint, chipboard, corrugated cardboard, or a combination of these materials

Alternate Fiber must comply with the following:

1. Long strand, whole natural fibers made from clean straw, cotton, corn, or other natural feed stock
2. At least 25 percent of fibers 3/8 inch long
3. At least 40 percent held on a No. 25 sieve

**Coloring Agent**

Use a biodegradable, nontoxic coloring agent free from copper, mercury, and arsenic.

**CONSTRUCTION**

**Site Preparation**

Immediately prior to applying seed to erosion control (Hydroseed) areas, trash and debris and weeds must be removed.

Removed weeds must be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

**Application**

Apply erosion control (Hydroseed) materials in separate applications in the following sequence:

1. Apply the following mixture with hydroseeding equipment at the rates indicated within 60 minutes after the seed has been added to the mixture:

Material	Pounds Per Acre (Slope Measurement)
Seed	64
Fiber	2200

2. Apply the following mixture with hydro-seeding equipment at the corresponding rates:

Material	Pounds Per Acre (Slope Measurement)
Fiber	2200

Hydraulic application of erosion control (Hydroseed) materials for rolled erosion control product (Netting) areas must be applied by hose, from the ground. Erosion control (Hydroseed) materials must be applied onto the slope face such that the materials are well integrated into the rolled erosion control product (Netting) and in contact with ground surface. Application must be perpendicular to the slope face such that rolled erosion control product (Netting) materials are not damaged or displaced.

Once straw work is started in an area, complete tackifier applications in that area on the same working day.

The Engineer may change the rates of erosion control (Hydroseed) materials to meet field conditions.

For any area where erosion control (Hydroseed) materials are to be applied, the application of all erosion control (Hydroseed) materials to be applied to that area must be completed within 72 hours from when the first materials were applied.

**MEASUREMENT AND PAYMENT**

Erosion control (Hydroseed) will be measured by the square foot or by the acre, whichever is designated in the Engineer's Estimate. The area will be calculated on the basis of actual or computed slope measurements.

The contract price paid per square foot or acre for erosion control (Hydroseed) includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in erosion control (Hydroseed) complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

**10-1.43 ROCK BLANKET**

Rock blanket shall be placed as shown on the plans and in conformance with these special provisions.

**MATERIALS**

Rock for the rock blanket shall be clean, smooth rock obtained from a single source.  
Rock shall conform to the following grading:

Screen Size (Inches)	Percentage Passing
8	100
6	50-85
4	0-50

A sample of the rock shall be submitted to the Engineer for approval prior to delivery of the rock to the project site.

Rock shall be secured in place with Class 2 concrete conforming to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications and these special provisions. Concrete aggregate size shall be 3/4 inch maximum.

**SITE PREPARATION**

Prior to beginning rock blanket work, areas to receive the rock blanket shall be cleared in conformance with the provisions in "Roadside Clearing" of these special provisions.

After clearing, the areas shall be excavated to the depth shown on the plans, graded to a smooth uniform surface and compacted to a minimum relative compaction of 90 percent.

After compaction, the areas shall be sterilized with dichlobenil. The sterilant shall be applied at the maximum label rate and shall not be applied more than 12 inches beyond the rock blanket limits. Soil sterilant shall conform to the provisions in Section 20-4.026, "Pesticides," of the Standard Specifications, except recommendations from a licensed Pest Control Adviser will not be required.

**PLACEMENT**

Rock shall be placed while concrete is still plastic, and spaced a maximum of 1/2 inch apart. The Contractor shall remove concrete adhering to the exposed surfaces of the rock. Loose rocks, or rock with a gap greater than 3/8 inch, measured from the edge of the rock to the surrounding concrete bedding shall be reset at the Contractor's expense by methods determined by the Engineer. Rock blanket shall not be placed to within 2 feet of ground cover areas and other plants.

**MEASUREMENT AND PAYMENT**

Rock blanket will be measured by the square yard as determined from actual measurements made parallel to the ground slope.

The contract price paid per square yard for rock blanket shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in placing rock blanket, complete in place, including furnishing and applying soil sterilant, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

**10-1.44 AGGREGATE BASE**

Aggregate bases must comply with Section 26, "Aggregate Bases," of the Standard Specifications and these special provisions.

Aggregate base must be Class 2 or Class 3 where specified.

Do not store reclaimed asphalt concrete or aggregate base with reclaimed asphalt concrete within 100 feet measured horizontally of any culvert, watercourse, or bridge.

For Class 3 aggregate base, choose the 1-1/2 inch maximum or the 3/4 inch maximum grading.

Aggregate for Class 3 aggregate base must comply with:

Grading (Percentage Passing )

Sieve Sizes	1-1/2 inch Maximum		3/4 inch Maximum	
	Operating Range	Contract Compliance	Operating Range	Contract Compliance
2"	100	100	-----	-----
1-1/2"	90 - 100	87 - 100	-----	-----
1"	-----	-----	100	100
3/4"	50 - 90	45 - 95	90 - 100	87 - 100
No. 4	25 - 60	20 - 65	40 - 70	35 - 75
No. 30	10 - 35	6 - 39	12 - 40	7 - 45
No. 200	3 - 15	0 - 19	3 - 15	0 - 19

Quality

Tests	Operating Range	Contract Compliance
Sand Equivalent	21 min.	18 min.
Resistance (R-value)	-----	50 min.
Durability Index	-----	35 min.

Do not treat aggregate with lime, cement, or other chemical material before the Department performs the Durability Index test. The Engineer does not consider any untreated processed asphalt concrete and portland cement concrete to be treated with lime, cement, or other chemical material for purposes of performing the Durability Index test.

If tests show grading or sand equivalent does not comply with the "Operating Range" specifications but complies with the "Contract Compliance" specifications, you may place aggregate base for the remainder of that day. Do not start another day's work until tests or other information indicate the next day's material complies with the "Operating Range" specifications.

If tests show grading or sand equivalent does not comply with the "Contract Compliance" specifications, remove the aggregate base represented by the tests. If you request and the Engineer approves, that aggregate base may remain in place and the Department reduces payment by \$2.25 per cubic yard for that aggregate base. If both the grading and sand equivalent do not comply with "Contract Compliance" specifications and the material is left in place, the Department only makes one payment reduction.

No single grading or sand equivalent test may represent more than the smaller of 500 cubic yards or one day's production.

If aggregate base is specified to be measured by the ton, the Engineer converts tons to cubic yards for the purpose of reducing payment for noncompliant aggregate base left in place.

**10-1.45 LEAN CONCRETE BASE**

Lean concrete base shall conform to the provisions in Section 28, "Lean Concrete Base," of the Standard Specifications.

**10-1.46 LEAN CONCRETE BASE RAPID SETTING**

**GENERAL**

**Summary**

Lean concrete base rapid setting (LCBRS) must comply with Section 28, "Lean Concrete Base," of the Standard Specifications and these special provisions.

**Definitions**

**final set time:** Time a specific penetration resistance of 4,000 psi is achieved, determined under ASTM C 403.

**opening age:** Time the concrete achieves the specified strength for opening to traffic.

**Submittals**

**Mix Design**

Determine the mix proportions for LCBRS and submit mix designs. At least 10 days before use, submit a mix design for LCBRS that includes:

1. Opening age
2. Proposed aggregate gradation
3. Proportions of hydraulic cement and aggregate
4. Types and amounts of chemical admixtures

5. Maximum time allowed between batching and placing
6. Range of ambient temperatures over which the mix design is effective
7. Final set time
8. Test result from California Test 548 testing, if required

Submit more than 1 mix design to plan for ambient temperature variations anticipated during LCBRS placement. Each mix design must have a maximum ambient temperature range of 18 °F.

Submit strength development data for each mix design. You may use strength development data from laboratory-prepared samples. The testing ages for strength development data must include 1 hour before opening age, opening age, 1 hour after opening age, 24 hours, and 7 days.

### Quality Control

Prepare compressive strength test specimens under California Test 540. Test compressive strength specimens under California Test 521. Perform at least 1 test at opening age for each 130 cubic yards placed. One test is two cylinders.

## MATERIALS

### Cement

Cement for LCBRS must comply with one of the following:

1. Cement for portland cement concrete specified in Section 90, "Portland Cement Concrete," of the Standard Specifications except Type III cement may be used.
2. A proprietary cementitious material in compliance with the specifications for cement in Section 90, "Portland Cement Concrete," of the Standard Specifications, except:

2.1. Cementitious material must meet the definition of hydraulic cement in ASTM C 219, and the following:

#### Proprietary Cementitious Material

Test Description	Test Method	Requirement
Contraction in Air	California Test 527, w/c ratio = 0.39±0.010	0.053%, max.
Mortar Expansion in Water	ASTM C 1038	0.04%, max.
Soluble Chloride*	California Test 422	0.05%, max.
Soluble Sulfate*	California Test 417	0.30%, max.
Thermal Stability	California Test 553	90%, min.
Compressive Strength @ 3 days	ASTM C 109	2500 psi

\*Test is to be done on a cube specimen fabricated in conformance with the requirements in ASTM C 109, cured at least 14 days, and then pulverized so that 100% passes the No. 50 sieve.

2.2. Citric acid or borax may be used if requested in writing by the cement manufacturer and a sample is submitted to the Engineer. Chemical admixtures, if used, must be included when testing for requirements listed in the table above.

### Aggregates

Aggregate for LCBRS must comply with either of the following:

1. Section 90-2.02, "Aggregates," and 90-3, "Aggregate Gradings," of the Standard Specifications
2. Section 28-1.02, "Materials," of the Standard Specifications and the following:
  - 2.1. The fifth paragraph of Section 28-1.02 does not apply
  - 2.2. Perform California Test 548 except part H.

## CONSTRUCTION

### General

LCBRS must have a compressive strength of 725 psi at opening age. Subsequent paving operations may commence only after opening age of LCBRS.

## Proportioning

Weighing, measuring, and metering devices used for proportioning materials must comply with Section 9-1.01, "Measurement of Quantities," of the Standard Specifications.

For central batch plants, indicators for weighing and measuring systems such as over and under dials must be grouped so that each indicator's smallest increment can be accurately read from the control point of the proportioning operation. In addition, indicators for weighing and measuring cement batched from a remote weighing system must be placed so that each indicator can be accurately read from the control point of the proportioning operation.

Weighing equipment must be insulated from other equipment's vibration or movement. When the plant is operating, each draft's material weight must not vary from the designated weight by more than the specified tolerances. Each scale graduation must be 0.001 of the usable scale capacity.

Aggregate must be weighed cumulatively. Equipment for weighing aggregate must have a zero tolerance of  $\pm 0.5$  percent of the aggregate's designated total batch weight. Equipment for the separate weighing of the cement must have a zero tolerance of  $\pm 0.5$  percent of the cement's designated individual batch draft. Equipment for measuring water must have a zero tolerance of  $\pm 0.5$  percent of the water's designated weight or volume.

The weight indicated for any individual batch of material must not vary from the preselected scale setting by more than:

Batch Weight Tolerances	
Material	Tolerance
Aggregate	$\pm 1.0$ percent of designated batch weight
Cement	$\pm 0.5$ percent of designated batch weight
Water	$\pm 1.5$ percent of designated batch weight or volume

If you choose aggregate that complies with Section 90-2.02, "Aggregates," and 90-3, "Aggregate Gradings," of the Standard Specifications, proportioning consists of dividing the aggregate into the specified sizes and storing them in separate bins, and then combining the aggregate with cement and water. Control the aggregate discharged from several bins with gates or mechanical conveyors. The means of discharge from the bins and from the weigh hopper must be interlocked so that no more than 1 bin can discharge at a time, and the weigh hopper cannot be discharged until the required quantity from each of the bins has been deposited in the weigh hopper.

Proportion dry ingredients by weight. Proportion liquid ingredients by weight or volume.

Handle and store aggregates under Section 90-5.01, "Storage of Aggregates," of the Standard Specifications. Proportion liquid admixtures under Section 90-4.10, "Proportioning and Dispensing Liquid Admixtures," of the Standard Specifications.

At the time of batching, dry and drain aggregates to a stable moisture content. Do not proportion aggregates with visible separation of water from the aggregate during proportioning. At the time of batching, the free moisture content of fine aggregate must not exceed 8 percent of its saturated, surface-dry weight.

If the proportioning plant has separate supplies of the same size group of aggregate with different moisture content, specific gravity, or surface characteristics affecting workability, exhaust 1 supply before using another supply.

Keep cement separated from the aggregate until discharged into the mixer. When discharged into the mixer, cement must be free of lumps and clods. Before reuse, clean fabric containers used for transportation or proportioning of cement.

Weigh systems for proportioning aggregate and cement must be individual and distinct from other weigh systems. Each weigh system must have a hopper, a lever system, and an indicator.

For batches with a volume of 1 cubic yard or more, proportioning must comply with one of the following methods:

1. Batch the ingredients at a central batch plant and charge them into a mixer truck for transportation to the pour site. Proportion ingredients under Section 90-5, "Proportioning," of the Standard Specifications.
2. Batch the ingredients except the cement at a central batch plant and charge them into a mixer truck for transportation to a cement silo and weigh system, which must proportion cement for charging into the mixer truck.
3. Batch ingredients except the cement at a central batch plant and charge them into a mixer truck for transportation to a location where pre-weighed containerized cement is added to the mixer truck. The cement pre-weighing operation must utilize a platform scale. The platform scale must have a maximum capacity of 2.75 tons with a maximum graduation size of 1 pound. Pre-weigh cement into a fabric container. The minimum amount of cement to be proportioned into any single container must be 1/2 of the total amount required for the load of LCBRS being produced.
4. Cement, water, and aggregate are proportioned volumetrically.

When ordered by the Engineer, determine the gross weight and tare weight of truck mixers on scales designated by the Engineer.

Install and maintain in operating condition an electrically actuated moisture meter. The meter must indicate on a readily visible scale the changes in the fine aggregate moisture content as it is batched. The meter must have a sensitivity of 0.5 percent by weight of the fine aggregate.

Obtain the Engineer's acceptance before mixing water into the concrete during hauling or after arrival at the delivery point. If the Engineer accepts additional water be incorporated into the concrete, the drum must revolve not less than 30 revolutions at mixing speed after the water is added and before starting discharge. Measure water added to the truck mixer at the job site through a meter in compliance with Section 9-1.01, "Measurement of Quantities," of the Standard Specifications.

### **Volumetric Proportioning**

You may choose to proportion LCBRS by volume.

Handle and store aggregates under Section 90-5.01, "Storage of Aggregates," of the Standard Specifications. Proportion liquid admixtures under Section 90-4.10, "Proportioning and Dispensing Liquid Admixtures," of the Standard Specifications.

Batch-mixer trucks must proportion cement, water, aggregate, and additives by volume. Aggregate feeders must be connected directly to the drive on the cement vane feeder. The cement feed rate must be tied directly to the feed rate for the aggregate and other ingredients. Only change the ratio of cement to aggregate by changing the gate opening for the aggregate feed. The drive shaft of the aggregate feeder must have a revolution counter reading to the nearest full or partial revolution of the aggregate delivery belt.

Proportion aggregate with a belt feeder operated with an adjustable cutoff gate delineated to the nearest quarter increment. The gate opening height must be readily determinable. Proportion cement by any method that complies with the accuracy tolerance specifications. Proportion water with a meter under Section 9-1.01, "Measurement and Payment," of the Standard Specifications.

Calibrate the cutoff gate for each batch-mixer truck used and for each aggregate source. Calibrate batch-mixer trucks at 3 different aggregate gate settings that are commensurate with production needs. Perform at least 2 calibration runs for each aggregate gate.

Individual aggregate delivery rate check-runs must not deviate more than 1.0 percent from the mathematical average of all runs for the same gate and aggregate type. Each test run must be at least 1,000 pounds.

At the time of batching, dry and drain aggregates to a stable moisture content. Do not proportion aggregates with visible separation of water from the aggregate during proportioning. At the time of batching, the free moisture content of fine aggregate must not exceed 8 percent of its saturated, surface-dry weight.

If the proportioning plant has separate supplies of the same size group of aggregate with different moisture content, specific gravity, or surface characteristics affecting workability, exhaust 1 supply before using another supply.

Cover rotating and reciprocating equipment on batch-mixer trucks with metal guards.

Individual cement delivery rate check-runs must not deviate more than 1.0 percent of the mathematical average of 3 runs of at least 1,000 pounds each.

When the water meter operates from 50 to 100 percent of production capacity, the indicated weight of water delivered must not differ from the actual weight delivered by more than 1.5 percent for each of 2 runs of 300 gallons. Calibrate the water meter under California Test 109. The water meter must be equipped with a resettable totalizer and display the operating rate.

Conduct calibration tests for aggregate, cement, and water proportioning devices with a platform scale located at the calibration site. Platform scales for weighing test-run calibration material must have a maximum capacity of 2.75 tons with maximum graduations of 1 pound. Error test the platform scale within 8 hours of calibrating the batch-mixer truck proportioning devices. Perform error-testing with test weights under California Test 109. Furnish a witness scale that is within 2 graduations of the test weight load. The witness scale must be available for use at the production site throughout the production period. Equipment needed for the calibration of proportioning systems must remain available at the production site throughout the production period.

The batch-mixer truck must be equipped so that accuracy checks can be made. Recalibrate proportioning devices every 30 days after production starts or when you change the source or type of any ingredient.

A spot calibration is calibration of the cement proportioning system only. Perform a 2-run spot calibration each time 55 tons of cement passes through the batch-mixer truck. If the spot calibration shows the cement proportioning system does not comply with the specifications, complete a full calibration of the cement proportioning system before you resume production.

Proportion liquid admixtures with a meter.

Locate cement storage immediately before the cement feeder. Equip the system with a device that automatically shuts down power to the cement feeder and aggregate belt feeder when the cement storage level is less than 20 percent of the total volume.

Submit aggregate moisture determinations, made under California Test 223, at least every 2 hours during proportioning and mixing operations. Record moisture determinations and submit them at the end of each production shift.

Equip each aggregate bin with a device that automatically shuts down the power to the cement feeder and the aggregate belt feeder when the aggregate discharge rate is less than 95 percent of the scheduled discharge rate.

Proportioning device indicators must be in working order before starting proportioning and mixing operations and must be visible when standing near the batch-mixer truck.

Identifying numbers of batch-mixer trucks must be at least 3 inches in height, and be located on the front and rear of the vehicles.

Mix volumetric proportioned LCBRS in a mechanically operated mixer. You may use auger-type mixers. Operate mixers uniformly at the mixing speed recommended by the manufacturer. Do not use mixers that have an accumulation of hard concrete or mortar.

Do not mix more material than will permit complete mixing. Reduce the volume of material in the mixer if complete mixing is not achieved. Continue mixing until a homogeneous mixture is produced at discharge. Do not add water to the LCBRS after discharge.

Do not use equipment with components made of aluminum or magnesium alloys that may have contact with plastic concrete during mixing or transporting of LCBRS.

The Engineer determines uniformity of concrete mixtures by differences in penetration measurements made under California Test 533. Differences in penetration are determined by comparing penetration tests on 2 samples of mixed concrete from the same batch or truck mixer load. The differences must not exceed 5/8 inch. Submit samples of freshly mixed concrete. Sampling facilities must be safe, accessible, clean, and produce a sample that is representative of production. Sampling devices and sampling methods must comply with California Test 125.

Do not use ice to cool LCBRS directly. If ice is used to cool water used in the mix, it must be melted before entering the mixer.

When proportioning and charging cement into the mixer, prevent variance of the required quantity by conditions such as wind or accumulation on equipment.

Each mixer must have metal plates that provide the following information:

1. Designed usage
2. Manufacturer's guaranteed mixed concrete volumetric capacity
3. Rotation speed

The device controlling the proportioning of cement, aggregate, and water must produce production data. The production data must be captured at 15-minute intervals throughout daily production. Each capture of production data represents production activity at that time and is not a summation of data. The amount of material represented by each production capture is the amount produced in the period from 7.5 minutes before to 7.5 minutes after the capture time. The daily production data must be submitted in electronic or printed media at the end of each production shift. The reported data must be in the order including data titles as follows:

1. Weight of cement per revolution count
2. Weight of each aggregate size per revolution count
3. Gate openings for each used aggregate size
4. Weight of water added to the concrete per revolution count
5. Moisture content of each used aggregate size
6. Individual volume of other admixtures per revolution count
7. Time of day
8. Day of week
9. Production start and stop times
10. Batch-mixer truck identification
11. Name of supplier
12. Specific type of concrete being produced
13. Source of the individual aggregate sizes
14. Source, brand, and type of cement
15. Source, brand and type of individual admixtures
16. Name and signature of operator

You may input production data by hand into a pre-printed form or it may be captured and printed by the proportioning device. Present electronic media containing recorded production data in a tab delimited format on a CD or DVD. Each capture of production data must be followed by a line-feed carriage-return with sufficient fields for the specified data.

### **Placing Concrete**

You may use metal or wood side forms. Wood side forms must not be less than 1-1/2 inches thick.

Side forms must remain in place until the LCBRS edge no longer requires the protection of forms.

After you deposit the LCBRS on the subgrade, consolidate it with high-frequency internal vibrators. Consolidate adjacent to forms and across the full placement width. Place LCBRS as nearly as possible to its final position. Do not use vibrators for extensive shifting of LCBRS.

Spread and shape LCBRS with powered finishing machines supplemented by hand finishing.

After you mix and place LCBRS, do not add water to the surface to facilitate finishing. Use surface finishing additives as recommended by the manufacturer of the cement after their use is approved by the Engineer.

### **Final Finishing**

The finished surface of LCBRS must not be above the grade established by the Engineer, or more than 0.05-foot below the grade established by the Engineer.

### **PAYMENT**

Lean concrete base rapid setting is measured and paid for by the cubic yard in the same manner specified for lean concrete base in Sections 28-1.09, "Measurement," and Section 28-1.09, "Payment," of the Standard Specifications.

## **10-1.47 HOT MIX ASPHALT**

### **GENERAL**

#### **Summary**

This work includes producing and placing hot mix asphalt (HMA) Type A and B using the Method and Quality Control / Quality Assurance process.

Comply with Section 39, "Hot Mix Asphalt," of the Standard Specifications.

#### **Submittals**

##### **Quality Control / Quality Assurance Projects**

With the job mix formula (JMF) submittal, submit:

1. California Test 204 plasticity index results
2. California Test 371 tensile strength ratio results for untreated HMA
3. California Test 371 tensile strength ratio results for treated HMA if untreated HMA tensile strength ratio is below 70

At project start-up and once during production, submit samples split from your HMA production sample for California Test 371 to the Engineer and the Transportation Laboratory, Attention: Moisture Test.

With the JMF submittal, at project start-up, and each 5,000 tons, submit the California Test 371 test results for mix design and production to the Engineer and electronically to:

Moisture\_Tests@dot.ca.gov

#### **Data Cores**

Three business days before starting coring, submit proposed methods and materials for backfilling data core holes. Submit to the Engineer and electronically to Coring@dot.ca.gov:

1. A summary of data cores taken
2. A photograph of each data core

For each data core, the summary must include:

1. Project identification number
2. Date cored
3. Core identification number
4. Type of materials recovered
5. Type and approximate thickness of unstabilized material not recovered
6. Total core thickness
7. Thickness of each individual material to within:
  - 7.1. For recovered material, 1/2 inch
  - 7.2. For unstabilized material, 1.0 inch

8. Location including:
  - 8.1. County
  - 8.2. Route
  - 8.3. Post mile
  - 8.4. Lane number
  - 8.5. Lane direction
  - 8.6. Station

Each data core digital photograph must include a ruler laid next to the data core. Each photograph must include:

1. The core
2. Project identification number
3. Core identification number
4. Date cored
5. County
6. Route
7. Post mile
8. Lane number
9. Lane direction

After data core summary and photograph submittal, dispose of cores under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

### Quality Control and Assurance

#### Quality Control / Quality Assurance Projects

For the mix design, determine the plasticity index of the aggregate blend under California Test 204. Choose an antistrip treatment and use the corresponding laboratory procedure for the mix design in compliance with:

#### Antistrip Treatment Lab Procedures for Mix Design

Antistrip Treatment	Lab Procedure
Plasticity index from 4 to 10 <sup>a</sup>	
Dry hydrated lime with marination	LP-6
Lime slurry with marination	LP-7
Plasticity index less than 4	
Liquid	LP-5
Dry hydrated lime without marination	LP-6
Dry hydrated lime with marination	LP-6
Lime slurry with marination	LP-7

Notes:

<sup>a</sup> If the plasticity index is greater than 10, do not use that aggregate blend.

For the mix design, determine tensile strength ratio under California Test 371 on untreated HMA. If the tensile strength ratio is less than 70:

1. Choose from the antistrip treatments specified based on plasticity index.
2. Test treated HMA under California Test 371.
3. Treat to a minimum tensile strength ratio of 70.

On the first production day and at least every 5,000 tons, sample HMA and test under California Test 371.

The Department does not use California Test 371 test results for JMF verification and production to determine specification compliance.

### MATERIALS

#### Asphalt Binder

The grade of asphalt binder mixed with aggregate for HMA Type A and B must be PG 64-10.

### **Aggregate**

The aggregate for HMA Type A and B must comply with the 3/4" maximum, medium grading.

## **CONSTRUCTION**

### **Vertical Joints**

Before opening the lane to public traffic, pave shoulders and median borders adjacent to a lane being paved.

Place HMA on adjacent traveled way lanes so that at the end of each work shift, the distance between the ends of HMA layers on adjacent lanes is between 5 feet and 10 feet. Place additional HMA along the transverse edge at each lane's end and along the exposed longitudinal edges between adjacent lanes. Hand rake and compact the additional HMA to form temporary conforms. You may place Kraft paper or another approved bond breaker under the conform tapers to facilitate the taper removal when paving operations resume.

### **Widening**

If widening existing pavement, construct new structural section on both sides of the existing pavement to match the elevation of the existing pavement's edge at each location before placing HMA over the existing pavement.

### **Conform Tapers**

Place shoulder conform tapers concurrently with the adjacent lane's paving.

### **Data Cores**

Take data cores that include the completed HMA pavement, underlying base, and subbase material. Protect data cores and surrounding pavement from damage.

Take 4-inch or 6-inch diameter data cores:

1. At the beginning, end, and every 1/2 mile within the paving limits of each route on the project
2. After all paving is complete
3. From the center of the specified lane

On a 2-lane roadway, take data cores from either lane. On a 4-lane roadway, take data cores from each direction in the outermost lane. On a roadway with more than 4 lanes, take data cores from the median lane and the outermost lane in each direction.

Each core must include the stabilized materials encountered. You may choose not to recover unstabilized material but you must identify the material. Unstabilized material includes:

1. Granular material
2. Crumbled or cracked stabilized material
3. Sandy or clayey soil

## **PAYMENT**

The contract lump sum price paid for data core includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in data coring, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

### **10-1.48 HOT MIX ASPHALT (MISCELLANEOUS AREAS)**

#### **GENERAL**

##### **Summary**

This work includes producing hot mix asphalt (HMA) and placing it on miscellaneous areas. Comply with Section 39, "Hot Mix Asphalt," of the Standard Specifications.

#### **MEASUREMENT AND PAYMENT**

If there is a contract item for place hot mix asphalt (miscellaneous area) paid for by the square yard, this item is limited to the areas listed on the plans and is in addition to the contract items for the materials involved.

Full compensation for tack coat for miscellaneous areas is considered as included in the contract price paid per ton for the hot mix asphalt used in miscellaneous areas and no separate payment will be made therefor.

## 10-1.49 HOT MIX ASPHALT AGGREGATE LIME TREATMENT - SLURRY METHOD

### GENERAL

#### Summary

This work includes treating hot mix asphalt (HMA) aggregate with lime using the slurry method and placing it in stockpiles to marinate.

Treat aggregate for hot mix asphalt (Type A and Type B) with lime slurry.

#### Submittals

Determine the exact lime proportions for fine and coarse virgin aggregate and submit them as part of the proposed job mix formula (JMF) under Section 39, "Hot Mix Asphalt," of the Standard Specifications.

Submit the averaged aggregate quality test results to the Engineer within 24 hours of sampling.

Submit a treatment data log from the slurry proportioning device in the following order:

1. Treatment date
2. Time of day the data is captured
3. Aggregate size being treated
4. Wet aggregate flow rate collected directly from the aggregate weigh belt
5. Moisture content of the aggregate just before treatment, expressed as a percent of the dry aggregate weight
6. Dry aggregate flow rate calculated from the wet aggregate flow rate
7. Lime slurry flow rate measured by the slurry meter
8. Dry lime flow rate calculated from the slurry meter output
9. Approved lime ratio for each aggregate size being treated
10. Actual lime ratio calculated from the aggregate weigh belt and the slurry meter output, expressed as a percent of the dry aggregate weight
11. Calculated difference between the approved lime ratio and the actual lime ratio
12. Dry lime and water proportions at the slurry treatment time

Every day during lime treatment, submit the treatment data log on electronic media in tab delimited format on a removable CD-ROM storage disk. Each continuous treatment data set must be a separate record using a line feed carriage return to present the specified data on one line. The reported data must include data titles at least once per report.

#### Quality Control and Assurance

Your quality control plan (QCP) must include aggregate quality control sampling and testing during aggregate lime treatment. Perform sampling and testing in compliance with:

#### Aggregate Quality Control During Lime Treatment

Quality Characteristic	Test Method	Minimum sampling and testing frequency
Sand Equivalent	CT 217	Once per 1,000 tons of aggregate treated with lime
Percent of crushed particles	CT 205	As necessary and as designated in the QCP
Los Angeles Rattler	CT 211	
Fine aggregate angularity	AASHTO T 304, Method A	
Flat and elongated particles	ASTM D 4791	

Note: During lime treatment, sample coarse and fine aggregate from individual stockpiles. Combine aggregate in the JMF proportions. Run tests for aggregate quality in triplicate and report test results as the average of 3 tests.

The Engineer orders proportioning operations stopped for any of the following if you:

1. Do not submit the treatment data log.
2. Do not submit the aggregate quality control data.
3. Submit incomplete, untimely, or incorrectly formatted data.
4. Do not take corrective actions.

5. Take late or unsuccessful corrective actions.
6. Do not stop treatment when proportioning tolerances are exceeded.
7. Use malfunctioning or failed proportioning devices.

If you stop treatment, notify the Engineer of any corrective actions taken and conduct a successful 20-minute test run before resuming treatment.

For the aggregate to be treated, determine the moisture content at least once during each 2 hours of treatment. Calculate moisture content under California Test 226 or California Test 370 and report it as a percent of dry aggregate weight. Use the moisture content calculations as a set point for the proportioning process controller.

## **MATERIALS**

High-calcium hydrated lime and water must comply with Section 24-1.02, "Materials," of the Standard Specifications.

Before virgin aggregate is treated, it must comply with the aggregate quality specifications. Do not test treated aggregate for quality control except for gradation. The Engineer does not test treated aggregate for acceptance except for gradation.

The Engineer determines the combined aggregate gradation during HMA production after you have treated aggregate. If reclaimed asphalt pavement (RAP) is used, the Engineer determines combined aggregate gradations containing RAP under Laboratory Procedure LP-9.

Treated aggregate must not have lime balls or clods.

## **CONSTRUCTION**

### **General**

Notify the Engineer at least 24 hours before the start of aggregate treatment.

Treat aggregate separate from HMA production.

Do not treat RAP.

Add lime to the aggregate as slurry consisting of mixed dry lime and water at a ratio of 1 part lime to between 2 parts and 3 parts water by weight. The slurry must completely coat the aggregate.

Lime treat and marinate coarse and fine aggregates separately.

Immediately before mixing lime slurry with aggregate, water must not visibly separate from aggregate.

Treat aggregate and stockpile for marination only once.

The lime ratio is the pounds of dry hydrated lime per 100 pounds of dry virgin aggregate expressed as a percent. Water content of slurry or untreated aggregate must not affect the lime ratio.

Lime ratio ranges are:

Aggregate Gradation	Lime Ratio
Coarse	0.4 to 1.0
Fine	1.5 to 2.0
Combined virgin aggregate	0.8 to 1.5

The lime ratio for fine and coarse aggregate must be within  $\pm 0.2$  percent of the lime ratio in the accepted JMF. The lime ratio must be within  $\pm 0.2$  percent of the approved lime ratio when you combine the individual aggregate sizes in the JMF proportions. The lime ratio must be determined before the addition of RAP.

If 3 consecutive sets of recorded treatment data indicate deviation more than 0.2 percent above or below the lime ratio in the accepted JMF, stop treatment.

If a set of recorded treatment data indicates a deviation of more than 0.4 percent above or below the lime ratio in the accepted JMF, stop treatment and do not use the material represented by that set of data in HMA.

If 20 percent or more of the total daily treatment indicates deviation of more than 0.2 percent above or below the lime ratio in the accepted JMF, stop treatment and do not use the day's total treatment in HMA.

If you stop treatment for noncompliance, you must implement corrective action and successfully treat aggregate for a 20-minute period. Notify the Engineer before beginning the 20-minute treatment period.

### **Lime Slurry Proportioning**

Proportion lime and water with a continuous or batch operation.

The device controlling slurry proportioning must produce a treatment data log. The log consists of a series of data sets captured at 10-minute intervals throughout daily treatment. The data must be a treatment activity register and not a summation. The material represented by the data set is the amount produced 5 minutes before and 5 minutes after the capture time. For the contract's duration, collected data must be stored by the controller.

### **Proportioning and Mixing Lime Slurry Treated Aggregate**

Treat HMA aggregate by proportioning lime slurry and aggregate by weight in a continuous operation.

Marinate treated aggregate in stockpiles from 24 hours to 60 days before using in HMA. Do not use aggregate marinated longer than 60 days.

### **MEASUREMENT AND PAYMENT**

Full compensation for treating aggregates with lime slurry shall be considered as included in the contract price paid per ton for HMA as designated in the Engineer's Estimate and no separate payment will be made therefor.

### **10-1.50 JOINTED PLAIN CONCRETE PAVEMENT**

#### **GENERAL**

##### **Summary**

This work includes constructing jointed plain concrete pavement.

Comply with Section 40, "Concrete Pavement," of the Standard Specifications.

##### **Submittals**

Submit AASHTO T 336 coefficient of thermal expansion test results to the Engineer.

For rejected test strips, submit a plan for changed materials, methods, or equipment before constructing additional test strips.

##### **Quality Control and Assurance**

###### **General**

Perform coefficient of thermal expansion testing under AASHTO T 336 at a frequency of 1 test for each day of paving.

Perform profilograph testing on concrete shoulders. Testing and test results must comply with the specifications for concrete pavement smoothness, profilograph test procedure, and corrective action for traffic lanes.

###### **Prepaving Conference**

Meet with the Engineer at a prepaving conference at a mutually agreed time and place. Discuss methods of performing the production and paving work.

Prepaving conference attendees must sign an attendance sheet provided by the Engineer. The prepaving conference must be attended by your:

1. Project superintendent
2. Quality control manager
3. Paving construction foreman
4. Subcontractor's workers including:
  - 4.1. Foremen
  - 4.2. Concrete plant manager
  - 4.3. Concrete plant operator
  - 4.4. Personnel performing saw cutting and joint sealing

Do not start paving activities including test strips until the listed personnel have attended a prepaving conference.

###### **Test Strips**

The first paving activity must be to construct a test strip:

1. 700 to 1,000 feet long
2. Same width as the planned paving
3. With the same equipment used for the planned paving

The Engineer evaluates the test strip for compliance with the specifications for Engineer's acceptance.

The Engineer selects from 6 to 12 core locations for dowel bars and up to 6 locations for tie bars per test strip.

If you use mechanical dowel bar inserters, the test strip must demonstrate they do not leave voids, segregations, or surface irregularities such as depressions, dips, or high areas.

Allow the Engineer 3 days to evaluate the test strip for:

1. Smoothness
2. Dowel bar and tie bar alignment
3. Thickness
4. Final finishing except coefficient of friction

During the 3-day evaluation, the Engineer rejects a test strip if:

1. Surface varies more than 0.02 foot from a 12-foot straightedge's lower edge
2. Wheel path's individual high points are greater than 0.025 foot in 25 feet
3. Dowel bars do not comply with specified placement tolerances
4. Concrete pavement thickness deficiency is greater than 0.05 foot
5. Final finishing does not comply with the specifications except coefficient of friction

Remove the test strip if the Engineer rejects it for noncompliance with the specifications for dowel bar alignment or thickness. Dispose of rejected test strip material under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

If the Engineer rejects the test strip for noncompliance with the smoothness or final finishing specifications except coefficient of friction, you may grind the test strip into compliance if you intend to leave it as part of the paving.

If the Engineer does not reject the test strip during the 3-day evaluation, you may begin production paving while the Engineer continues to evaluate the test strip for compliance with the other specifications. If the Engineer rejects the test strip for noncompliance with the other specifications, stop production paving until you construct a test strip the Engineer accepts.

Construct additional test strips until the Engineer accepts one.

Construct additional test strips if:

1. You propose different paving equipment including:
  - 1.1. Batch plant
  - 1.2. Paver
  - 1.3. Dowel bar inserter
  - 1.4. Tie bar inserter
  - 1.5. Tining
  - 1.6. Curing equipment
2. You change concrete mix proportions

The Engineer may allow paving to start without a test strip if you use a batch plant mixer, paving equipment, and personnel that completed a Department project within the preceding 12 months. Submit supporting documents and previous project information.

## **MATERIALS**

### **Joint Sealant for Isolation Joints**

Joint sealant for isolation joints must be compression seal.

### **Joint Seal**

Use compression seal for transverse and longitudinal contraction and construction joints.

### **Joint Filler for Isolation Joints**

Joint filler for isolation joints must be bituminous expansion joint filler.

### **Tack Coat**

Tack coat must comply with Section 39, "Hot Mix Asphalt," of the Standard Specifications.

## **CONSTRUCTION**

### **Tie Bar Spacing On Curves**

If the curvature of a concrete pavement slab prevents equal spacing of tie bars to maintain the minimum clearance from transverse joints, space them from 15 to 18 inches.

### **Transverse Contraction Joints**

Transverse contraction joints must be Type A1. If widening existing concrete pavement, do not construct transverse contraction joints to match the existing pavement's joint spacing or skew unless specified. Transverse joints in concrete pavement on a curve must be on a single straight line through the curve's radius point.

### **Longitudinal Contraction Joints**

Longitudinal contraction joints must be Type A2.

### **Transition Joints With Hot Mix Asphalt**

If a joint between concrete pavement and hot mix asphalt is specified, apply tack coat between the concrete pavement and hot mix asphalt.

### **Concrete Pavement Removal**

When removing and replacing concrete, remove it to full depth and width.

### **Crack Treatment**

If cracks form that do not extend to the full depth of a slab, treat the cracks with a high molecular weight methacrylate resin under "Concrete Pavement Crack Treatment."

### **Removal and Replacement of Slabs Without Bar Reinforcement**

For full depth and partial length slab removal, saw cut the full depth and width.

Saw cut full slabs at the longitudinal and transverse joints. Saw cut partial slabs at joints and where the Engineer orders. You may make additional saw cuts within the removal area to facilitate slab removal or to prevent binding of the saw cut at the removal area's edge. Saw cut perpendicular to the slab surface.

Use slab lifting equipment with lifting devices that attach to the slab. After lifting the slab, paint the cut ends of dowels and tie bars.

Construct transverse and longitudinal construction joints between the new slab and existing concrete using dowel bars. For longitudinal joints, offset dowel bar holes from original tie bars by 3 inches. For transverse joints, offset dowel bar holes from the original dowel bars by 3 inches.

Drill holes and use chemical adhesive to bond the dowel bars to the existing concrete. Use an automated dowel bar drilling machine. Holes must be at least 1/8-inch greater than the dowel bar diameter. Clean the holes in compliance with the chemical adhesive manufacturer's instructions. Holes must be dry when you place chemical adhesive.

Immediately after inserting dowel bars into the chemical adhesive-filled holes, support the dowel bars and leave them undisturbed for the minimum cure time recommended by the chemical adhesive manufacturer.

Clean the faces of joints and underlying base from loose material and contaminants. Coat the faces with a double application of pigmented curing compound under Section 28-1.07, "Curing," of the Standard Specifications. For partial slab replacements, place preformed sponge rubber expansion joint filler at new transverse joints in compliance with ASTM D 1752.

## **MEASUREMENT AND PAYMENT**

If the Engineer accepts a test strip and it remains as part of the paving surface, the test strip is measured and paid for as jointed plain concrete pavement, seal pavement joint, and seal isolation joint as the case may be.

Transition panels to asphalt concrete pavement are measured and paid for as jointed plain concrete pavement.

Full compensation for providing a facility for and attending the prepaving conference is included in the contract price paid per cubic yard for jointed plain concrete pavement and no additional compensation is allowed therefor.

Full compensation for applying tack coat at transverse transition joints and end anchors is included in the contract price paid per cubic yard for jointed plain concrete pavement and no separate payment is made therefor.

If the curvature of a slab affects tie bar spacing and additional tie bars are required, they are included in the contract price paid per cubic yard for jointed plain concrete pavement and no additional compensation is allowed therefor.

### **10-1.51 JOINTED PLAIN CONCRETE PAVEMENT (RAPID STRENGTH CONCRETE)**

#### **GENERAL**

##### **Summary**

This work includes constructing jointed plain concrete pavement (JPCP) with rapid strength concrete (RSC). Comply with Section 40, "Concrete Pavement," of the Standard Specifications.

## Definitions

**early age:** Time less than 10 times the concrete's final set time.

**final set time:** Time a specific penetration resistance of 4,000 psi is achieved, determined under ASTM C 403.

**opening age:** Time the concrete achieves the specified strength for opening to traffic.

**transverse crack:** A crack running from one longitudinal edge of the panel to the other.

## Submittals

Submit AASHTO T 336 coefficient of thermal expansion test results to the Engineer and at the website <http://169.237.179.13/cte/>.

For rejected test strips, submit a plan for changed materials, methods, or equipment before constructing additional test strips.

## Quality Control and Assurance

### General

#### Prepaving Conference

Meet with the Engineer at a prepaving conference at a mutually agreed time and place. Discuss methods of performing the production and paving work.

Prepaving conference attendees must sign an attendance sheet provided by the Engineer. The prepaving conference must be attended by your:

1. Project superintendent
2. Quality control manager
3. Paving construction foreman
4. Subcontractor's workers including:
  - 4.1. Foremen
  - 4.2. Concrete plant manager
  - 4.3. Concrete plant operator
  - 4.4. Personnel performing saw cutting and joint sealing

Do not start paving activities including test strips until the listed personnel have attended a prepaving conference.

### Mix Design

At least 10 days before use in a test strip, submit a mix design for RSC that includes:

1. Opening age
2. Proposed aggregate gradation
3. Proportions of hydraulic cement and aggregate
4. Types and amounts of chemical admixtures
5. Maximum time allowed between batching and placing
6. Range of ambient temperatures over which the mix design is effective
7. Final set time
8. Any special instructions or conditions such as water temperature requirements

Submit more than 1 mix design to plan for ambient temperature variations anticipated during RSC placement. Each mix design must have a maximum ambient temperature range of 18 °F.

Submit modulus of rupture development data for each mix design. You may use modulus of rupture development data from laboratory-prepared samples. The testing ages for modulus of rupture development data must include 1 hour before opening age, opening age, one hour after opening age, 24 hours, 7 days, and 28 days.

During concrete mix design, perform coefficient of thermal expansion testing under AASHTO T 336 from trial mixture samples. Provide a split test sample to METS. If changing an aggregate supply source or the mix properties or proportions, perform coefficient of thermal expansion testing for the new concrete mix.

## **Calibration Testing Certificates of Compliance**

Submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications with each delivery of aggregate, cement, and admixtures to be used for calibration tests. Submit certified copies of the weight of each delivery. The Certificate of Compliance must state the source of materials used for the calibration tests is from the same source to be used in the work. The Certificate of Compliance must be signed by your authorized representative.

### **Cement and Admixtures**

At least 45 days before intended use, submit a sample of cement from each proposed lot and samples of proposed admixtures in the quantities ordered by the Engineer.

During RSC pavement operations, submit uniformity reports for hydraulic cement at least once every 30 days to the Transportation Laboratory, Attention: Cement Laboratory. Uniformity reports must comply with ASTM C 917, except testing age and water content may be modified to suit the particular material.

### **Quality Control Program**

#### **General**

Establish a quality control program. The quality control program assures the Engineer that methods and procedures are in place to produce and place RSC in compliance with the specifications.

If the quality control program is not implemented and followed, the Engineer orders RSC work stopped.

#### **Quality Control Managers**

For the project, designate a lead QCM and assistant QCMs.

The lead QCM administers the quality control plan (QCP). The lead QCM must hold current American Concrete Institute (ACI) certification as "Concrete Field Testing Technician-Grade I" and "Concrete Laboratory Testing Technician-Grade II." Assistant QCMs must hold current ACI certification as "Concrete Field Testing Technician-Grade I" and either "Concrete Laboratory Testing Technician-Grade I" or "Concrete Laboratory Testing Technician-Grade II."

The QCM responsible for the production period involved must review and sign the sampling, inspection, and test reports before submittal to the Engineer. At least 1 QCM must be present for:

1. Each stage of mix design
2. Test strip construction
3. Production and construction of RSC
4. Meetings with the Engineer relating to production, placement, or testing.

A QCM must not be a member of this project's production or paving crews, an inspector, or a tester. A QCM must have no duties during the production and placement of RSC except those specified.

#### **Quality Control Plan**

The QCP describes the procedures you will use to control the production process including:

1. Determining if changes to the production process are needed
2. Procedures for proposing changes
3. Procedures for implementing changes

Do not start RSC work until the QCP has been accepted by the Engineer. The Engineer accepts the QCP based the inclusion and adequacy of:

1. The names and qualifications of the lead Quality Control Manager (QCM) and assistant QCMs.
2. An outline procedure for the placement and testing of test strips
3. An outline procedure for the production, transportation, and placement of RSC
4. An outline procedure for sampling and testing to be performed during and after RSC construction
5. A contingency plan for correcting problems in production, transportation, or placement. Include the quantity and location of standby material in your contingency plan.
6. Provisions for determining if RSC placement must be suspended and temporary roadway pavement structure constructed
7. Forms to report inspection, sampling, and testing
8. The location of your quality control testing laboratory and testing equipment during and after paving operations
9. A list of the testing equipment to be used including date of last calibration
10. The names and certifications of quality control personnel including those performing sampling and testing

At the time of QCP submission, the Department qualifies the quality control samplers and testers through the Independent Assurance Program (IAP) for the sampling and testing they perform.

### **Quality Control Inspection, Sampling, and Testing**

Perform quality control sampling, testing, and inspection throughout RSC production and placement. Before any sampling and testing, give the Engineer at least 2 business days notice. Give the Engineer unrestricted access to your quality control inspectors, samplers, testers, and laboratories. Submit testing results within 15 minutes of testing completion. Record inspection, sampling, and testing on the forms accepted with the QCP and submit them within 48 hours of completion of each paving shift and within 24 hours of 7-day modulus of rupture tests.

Provide a testing laboratory to perform quality control tests. Maintain sampling and testing equipment in proper working condition. Perform sampling under California Test 125.

Testing laboratories and testing equipment must comply with the Department's Independent Assurance Program.

### **Test Strips**

The first paving activity must be to construct a test strip:

1. 700 to 1,000 feet long
2. Same width as the planned paving
3. With the same equipment used for the planned paving

The Engineer evaluates the test strip for compliance with the specifications for Engineer's acceptance.

The Engineer selects from 6 to 12 core locations for dowel bars and up to 6 locations for tie bars per test strip.

If you use mechanical dowel bar inserters, the test strip must demonstrate they do not leave voids, segregations, or surface irregularities such as depressions, dips, or high areas.

Allow the Engineer 3 days to evaluate the test strip for:

1. Smoothness
2. Dowel bar and tie bar alignment
3. Thickness
4. Final finishing except coefficient of friction

During the 3-day evaluation, the Engineer rejects a test strip if:

1. Surface varies more than 0.02 foot from a 12-foot straightedge's lower edge
2. Wheel path's individual high points are greater than 0.025 foot in 25 feet
3. Dowel bars do not comply with specified placement tolerances
4. Concrete pavement thickness deficiency is greater than 0.05 foot
5. Final finishing does not comply with the specifications except coefficient of friction

Remove the test strip if the Engineer rejects it for noncompliance with the specifications for dowel bar alignment or thickness. Dispose of rejected test strip material under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

If the Engineer rejects the test strip for noncompliance with the smoothness or final finishing specifications except coefficient of friction, you may grind the test strip into compliance if you intend to leave it as part of the paving.

If the Engineer does not reject the test strip during the 3-day evaluation, you may begin production paving while the Engineer continues to evaluate the test strip for compliance with the other specifications. If the Engineer rejects the test strip for noncompliance with the other specifications, stop production paving until you construct a test strip the Engineer accepts.

Construct additional test strips until the Engineer accepts one.

Construct additional test strips if:

1. You propose different paving equipment including:
  - 1.1. Batch plant
  - 1.2. Paver
  - 1.3. Dowel bar inserter
  - 1.4. Tie bar inserter
  - 1.5. Tining
  - 1.6. Curing equipment

## 2. You change concrete mix proportions

During test strip construction, sample and split the aggregate for gradings, cleanness value, and sand equivalent testing. Test strip must comply with the QCP for RSC production and placement. The QCP must detail your intended:

1. Locations and times
2. Production procedures
3. Placement and finishing methods
4. Sampling methods, sample curing, and sample transportation
5. Testing and test result reporting

Within 20 minutes after rapid strength concrete delivery for test strips, fabricate test beams under California Test 524. Use beams to determine early age and 7-day modulus of rupture values.

Cure beams fabricated for early age testing so that the monitored temperatures in the beams and the test strip are always within 5 °F. Monitor and record the internal temperatures of test strip and early age beams at intervals of at least 5 minutes. Install thermocouples or thermistors connected to strip-chart recorders or digital data loggers to monitor the temperatures. Temperature recording devices must be accurate to within  $\pm 2$  °F. Measure internal temperatures at 1 inch from the top, 1 inch from the bottom, and no closer than 3 inches from any edge until early age testing is completed.

Cure beams fabricated for 7-day testing under California Test 524 except place them into sand at a time that is from 5 to 10 times the final set time, or 24 hours, whichever is earlier.

Test strip must have an early age modulus of rupture of not less than 400 psi and a 7-day modulus of rupture of not less than 600 psi.

Dispose of test strip and test specimens for test strip under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

### **Production Process Control and Quality Control Testing**

Contingency plan equipment and personnel must be present at the job site.

Provide continuous process control and quality control sampling and testing throughout RSC production and placement.

During production of RSC, sample and test aggregates at least once for every 650 cubic yards of RSC produced, but not less than once per placement shift. Test aggregates for compliance with gradations, cleanness value, and sand equivalent specifications.

At least once for every 650 cubic yards of RSC produced, but not less than twice per placement shift, sample and test for:

1. Yield
2. Penetration
3. Air content
4. Unit weight

During placement of RSC, fabricate beams and test for modulus of rupture within the first 30 cubic yards, at least once every 130 cubic yards, and within the final truckload.

If the Engineer requests, submit split samples and fabricate test beams for the Engineer's testing.

For determining early age modulus of rupture, cure beams under the same conditions as the pavement until 1 hour before testing. Cure beams fabricated for the 7-day test under California Test 524. The Engineer uses modulus of rupture test results for accepting or rejecting the replacement pavement and pay factor adjustment for low modulus of rupture.

Dispose of materials resulting from the construction of the test beams, temporary roadway pavement structure, and rejected replacement pavement under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

### **Weighmaster Certificates**

Weighmaster certificates for RSC, regardless of the proportioning method used, must include the information necessary to trace the manufacturer and the manufacturer's lot number for the cement being used. If proportioned into fabric containers, the weighmaster certificates for the cement must contain date of proportioning, location of proportioning, and actual net draft cement weight. If proportioned at the pour site from a storage silo, the weighmaster certificates must contain date of proportioning, location of proportioning, and the net draft cement weight used in the load.

**Engineer's Acceptance for Modulus of Rupture**

RSC pavement must develop a minimum modulus of rupture of 400 psi before opening to traffic. RSC pavement must develop a minimum modulus of rupture of 600 psi 7 days after placement. The Engineer may accept RSC pavement that does not attain the specified moduli of rupture as specified in "Pay Factor Adjustment for Low Modulus of Rupture." The Engineer determines the modulus of rupture by testing 3 beam specimens under California Test 524 and averaging the results. You may fabricate beam specimens using an internal vibrator under ASTM C 31. No single test represents more than that day's production or 130 cubic yards, whichever is less.

Beam specimens for early age must be cured so the temperature in the specimens is within 5 °F of the temperature in the pavement. You must determine the modulus of rupture at other ages using beams cured and tested under California Test 524 except place them in sand from 5 to 10 times the final set time or 24 hours, whichever is earlier. You must perform the testing to determine modulus of rupture values of the RSC pavement in the presence of the Engineer.

**Pay Factor Adjustment for Low Modulus of Rupture**

The Engineer adjusts payment for RSC for modulus of rupture as follows:

1. Payment for RSC with a modulus of rupture of 400 psi or greater before opening to traffic and 7-day modulus of rupture of 600 psi or greater is not adjusted.
2. Payment for RSC with a 7-day modulus of rupture less than 500 psi is not adjusted and no payment is made. Remove this RSC and replace it at your expense with RSC that complies with the specifications.
3. Payment for RSC with a modulus of rupture less than 350 psi before opening to traffic is not adjusted and no payment is made. Remove this RSC and replace it at your expense with RSC that complies with the specifications.
4. Payment for RSC with a modulus of rupture of 350 psi or greater before opening to traffic and a 7-day modulus of rupture greater than or equal to 500 psi is reduced by the percentage in the pay table for the quantity represented by the tests.

**Percentage Pay Table**

Modulus of Rupture (psi) at opening to traffic	7-Day Modulus of Rupture (psi)		
	Greater than or equal to 600	Less than 600 and greater than or equal to 550	Less than 550 and greater than or equal to 500
Greater than or equal to 400	100%	95%	90%
Less than 400 and greater than or equal to 350	95%	95%	90%
Less than 350	0%	0%	0%

The Engineer rejects any RSC area that develops 1 or more transverse full depth random cracks within 64 days after placement. Remove this RSC at your expense and replace it with RSC that complies with the specifications.

**Test Section for 550 psi Opening Strength**

Where shown on the plans, construct a test section of RSC with an early age modulus of rupture of not less than 550 psi and a 7-day modulus of rupture of not less than 650 psi.

**Engineer's Acceptance for Modulus of Rupture for 550 psi Test Section**

RSC pavement must develop a minimum modulus of rupture of 550 psi before opening to traffic and a minimum modulus of rupture of 650 psi 7 days after placement. The Engineer does not accept RSC pavement that does not attain the modulus of rupture as specified. The Engineer determines the modulus of rupture by testing 3 beam specimens under California Test 524 and averaging the results. You may fabricate beam specimens using an internal vibrator under ASTM C 31. No single test represents more than that day's production or 130 cubic yards, whichever is less.

Pay factor adjustment does not apply to RSC for the 550 psi test section.

If the specified early age and 7 day modulus of rupture is not met, you must remove the test section and replace it at your expense.

## MATERIALS

### Temporary Roadway Pavement Structure

#### Aggregate Base

Aggregate base for temporary roadway pavement structure must be produced from any combination of broken stone, crushed gravel, natural rough-surfaced gravel, reclaimed concrete and sand. Grading of aggregate base must comply with the 3/4-inch maximum grading specified in Section 26-1.02A, "Class 2 Aggregate Base," of the Standard Specifications.

#### Hot Mix Asphalt

For hot mix asphalt:

1. Choose the 3/8-inch or 1/2-inch HMA Type A or Type B aggregate gradation under Section 39-1.02E, "Aggregate," of the Standard Specifications.
2. Minimum asphalt binder content must be 6.8 percent for 3/8-inch aggregate gradation and 6.0 percent for 1/2-inch aggregate gradation.
3. Choose asphalt binder Grade PG 64-10, PG 64-16, or PG 70-10 under Section 92, "Asphalts," of the Standard Specifications.

#### Rapid Strength Concrete

RSC that fails to meet opening strength but has a modulus of rupture of at least 200 psi may serve as temporary roadway and must be replaced prior to acceptance of the contract.

#### Bond Breaker

Bond breaker must be one of the following:

1. White curing paper under ASTM C 171
2. White opaque polyethylene film under ASTM C 171, except that the minimum thickness must be 6 mils
3. Paving asphalt, Grade PG 64-10, under Section 92, "Asphalts," of the Standard Specifications
4. Curing compound (5) under Section 90-7.01b, "Curing Compound Method," of the Standard Specifications

#### Rapid Strength Concrete

RSC must be one of the following:

1. Concrete complying with section 90 "Portland Cement Concrete", except you may use Type III portland cement.
2. Concrete complying with section 90 "Portland Cement Concrete", except:
  - 2.1. You may use any cement that complies with the definition of hydraulic cement or blended hydraulic cement in ASTM C 219 and the requirements shown in the following table:

#### Hydraulic Cement<sup>c</sup>

Test Description	Test Method	Requirement <sup>b</sup>
Contraction in air	California Test 527, W/C Ratio = 0.39 ±0.010	0.053 %, max.
Mortar expansion in water	ASTM C 1038	0.04 %, max.
Soluble chloride <sup>a</sup>	California Test 422	0.05 %, max.
Soluble sulfates <sup>a</sup>	California Test 417	0.30 %, max.
Thermal stability	California Test 553	90 %, min.
Compressive strength @ 3 days	ASTM C 109	2,500 psi

Note:

<sup>a</sup> Perform test on a cube specimen fabricated under ASTM C 109. Cure the specimen at least 14 days and then pulverized to 100 percent passing the No. 50 sieve.

<sup>b</sup> If you use chemical admixtures, include them when testing.

<sup>c</sup> The requirements of this table does not apply to portland cement.

- 2.2. You may use citric acid or borax if you submit a written request from the cement manufacturer and a test sample.

Supplementary cementitious material is not required in RSC.

Choose the combined aggregate grading for RSC from either the 1-1/2 inch maximum or the 1-inch maximum combined grading under Section 90-3.04, "Combined Aggregate Gradings," of the Standard Specifications.

You may use Type C accelerating and Type E accelerating and water reducing chemical admixtures as specified in Section 90-4, "Admixtures," of the Standard Specifications. The requirement for air entrainment of concrete in freeze-thaw areas only applies when portland cement is used.

#### **Joint Seal**

Use compression seal for **seal existing pavement transverse and longitudinal joints.**

#### **Joint Seal for Isolation Joints**

**Joint seal for isolation joints must be compression seal.**

#### **Joint Filler for Isolation Joints**

Joint filler for isolation joints must be **bituminous expansion joint filler.**

#### **Tack Coat**

Tack coat must comply with Section 39, "Hot Mix Asphalt," of the Standard Specifications.

### **CONSTRUCTION**

#### **Tie Bar Spacing On Curves**

If the curvature of a concrete pavement slab prevents equal spacing of tie bars to maintain the minimum clearance from transverse joints, space them from 15 to 18 inches.

#### **Transverse Contraction Joints**

Transverse contraction joints must be Type **A-1**. If widening existing concrete pavement, do not construct transverse contraction joints to match the existing pavement's joint spacing or skew unless specified. Transverse joints in concrete pavement on a curve must be on a single straight line through the curve's radius point.

#### **Longitudinal Contraction Joints**

Longitudinal contraction joints must be Type **A-2**.

#### **Transition Joints With Hot Mix Asphalt**

If a joint between concrete pavement and hot mix asphalt is specified, apply tack coat between the concrete pavement and hot mix asphalt.

#### **Temporary Roadway Pavement Structure**

Place hot mix asphalt and aggregate base where existing pavement is replaced for construction of a temporary roadway pavement structure. The quantity must be equal to the quantity of pavement removed during the work shift. If you place temporary roadway pavement structure, it must be maintained and later removed as the first order of work when JPCP (RSC) activities resume. The temporary roadway pavement structure must consist of 3-1/2 inch thick hot mix asphalt over aggregate base. RSC not conforming to the specifications may be used for temporary roadway pavement structure with the Engineer's approval.

Spread and compact aggregate base and hot mix asphalt by methods that produce a well-compacted, uniform base, with a surface of uniform smoothness, texture and density. Surfaces must be free from pockets of coarse or fine material. You may spread aggregate base and hot mix asphalt each in one layer. The finished surface of hot mix asphalt must not vary more than 0.05 foot from the lower edge of a 12-foot long straightedge placed parallel with the centerline and must match the elevation of existing concrete pavement along the joints between the existing pavement and temporary surfacing.

After removing temporary roadway pavement structure, you may stockpile removed aggregate base at the project site and reuse it for temporary roadway pavement structures. When no longer required, dispose of standby material or stockpiled material for temporary roadway pavement structures under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

#### **Rapid Strength Concrete**

##### **General**

Concrete pavement penetration specified in Section 90-6.06, "Amount of Water and Penetration," of the Standard Specifications does not apply to RSC.

RSC must develop the specified opening age and 7-day modulus of rupture strengths.

## Proportioning

Weighing, measuring, and metering devices used for proportioning materials must comply with Section 9-1.01, "Measurement of Quantities," of the Standard Specifications.

For batches with a volume of 1 cubic yard or more, proportioning must comply with one of the following methods:

1. Batch the ingredients at a central batch plant and charge them into a mixer truck for transportation to the pour site. Proportion ingredients under Section 90-5, "Proportioning," of the Standard Specifications.
2. Batch the ingredients except the cement at a central batch plant and charge them into a mixer truck for transportation to a cement silo and weigh system, which must proportion cement for charging into the mixer truck.
3. Batch ingredients except the cement at a central batch plant and charge them into a mixer truck for transportation to a location where pre-weighed containerized cement is added to the mixer truck. The cement pre-weighing operation must utilize a platform scale. The platform scale must have a maximum capacity of 2.75 tons with a maximum graduation size of 1 pound. Pre-weigh cement into a fabric container. The minimum amount of cement to be proportioned into any single container must be 1/2 of the total amount required for the load of RSC being produced.
4. Cement, water, and aggregate are proportioned volumetrically.

For central batch plants, indicators for weighing and measuring systems such as over and under dials must be grouped so that each indicator's smallest increment can be accurately read from the control point of the proportioning operation. In addition, indicators for weighing and measuring cement batched from a remote weighing system must be placed so that each indicator can be accurately read from the control point of the proportioning operation.

Weighing equipment must be insulated from other equipment's vibration or movement. When the plant is operating, each draft's material weight must not vary from the designated weight by more than the specified tolerances. Each scale graduation must be 0.001 of the usable scale capacity.

Aggregate must be weighed cumulatively. Equipment for weighing aggregate must have a zero tolerance of  $\pm 0.5$  percent of the aggregate's designated total batch weight. Equipment for the separate weighing of the cement must have a zero tolerance of  $\pm 0.5$  percent of the cement's designated individual batch draft. Equipment for measuring water must have a zero tolerance of  $\pm 0.5$  percent of the water's designated weight or volume.

The weight indicated for any individual batch of material must not vary from the preselected scale setting by more than:

**Batch Weight Tolerances**

Material	Tolerance
Aggregate	$\pm 1.0$ percent of designated batch weight
Cement	$\pm 0.5$ percent of designated batch weight
Water	$\pm 1.5$ percent of designated batch weight or volume

Proportioning consists of dividing the aggregate into the specified sizes and storing them in separate bins, and then combining the aggregate with cement and water. Proportion dry ingredients by weight. Proportion liquid ingredients by weight or volume.

Handle and store aggregates under Section 90-5.01, "Storage of Aggregates," of the Standard Specifications. Proportion liquid admixtures under Section 90-4.10, "Proportioning and Dispensing Liquid Admixtures," of the Standard Specifications.

Control aggregate discharged from several bins with gates or mechanical conveyors. The means of discharge from the bins and from the weigh hopper must be interlocked so that no more than 1 bin can discharge at a time, and the weigh hopper cannot be discharged until the required quantity from each of the bins has been deposited in the weigh hopper.

At the time of batching, dry and drain aggregates to a stable moisture content. Do not proportion aggregates with visible separation of water from the aggregate during proportioning. At the time of batching, the free moisture content of fine aggregate must not exceed 8 percent of its saturated, surface-dry weight.

If the proportioning plant has separate supplies of the same size group of aggregate with different moisture content, specific gravity, or surface characteristics affecting workability, exhaust 1 supply before using another supply.

Keep cement separated from the aggregate until discharged into the mixer. When discharged into the mixer, cement must be free of lumps and clods. Before reuse, clean fabric containers used for transportation or proportioning of cement.

Weigh systems for proportioning aggregate and cement must be individual and distinct from other weigh systems. Each weigh system must have a hopper, a lever system, and an indicator.

When ordered by the Engineer, determine the gross weight and tare weight of truck mixers on scales designated by the Engineer.

Install and maintain in operating condition an electrically actuated moisture meter. The meter must indicate on a readily visible scale the changes in the fine aggregate moisture content as it is batched. The meter must have a sensitivity of 0.5 percent by weight of the fine aggregate.

Obtain the Engineer's acceptance before mixing water into the concrete during hauling or after arrival at the delivery point. If the Engineer accepts additional water be incorporated into the concrete, the drum must revolve not less than 30 revolutions at mixing speed after the water is added and before starting discharge. Measure water added to the truck mixer at the job site through a meter in compliance with Section 9-1.01, "Measurement of Quantities," of the Standard Specifications.

### **Volumetric Proportioning**

You may choose to proportion RSC by volume.

Handle and store aggregates under Section 90-5.01, "Storage of Aggregates," of the Standard Specifications. Proportion liquid admixtures under Section 90-4.10, "Proportioning and Dispensing Liquid Admixtures," of the Standard Specifications.

Batch-mixer trucks must proportion cement, water, aggregate, and additives by volume. Aggregate feeders must be connected directly to the drive on the cement vane feeder. The cement feed rate must be tied directly to the feed rate for the aggregate and other ingredients. Only change the ratio of cement to aggregate by changing the gate opening for the aggregate feed. The drive shaft of the aggregate feeder must have a revolution counter reading to the nearest full or partial revolution of the aggregate delivery belt.

Proportion aggregate with a belt feeder operated with an adjustable cutoff gate delineated to the nearest quarter increment. The gate opening height must be readily determinable. Proportion cement by any method that complies with the accuracy tolerance specifications. Proportion water with a meter under Section 9-1.01, "Measurement and Payment," of the Standard Specifications.

Calibrate the cutoff gate for each batch-mixer truck used and for each aggregate source. Calibrate batch-mixer trucks at 3 different aggregate gate settings that are commensurate with production needs. Perform at least 2 calibration runs for each aggregate gate.

Individual aggregate delivery rate check-runs must not deviate more than 1.0 percent from the mathematical average of all runs for the same gate and aggregate type. Each test run must be at least 1,000 pounds.

At the time of batching, dry and drain aggregates to a stable moisture content. Do not proportion aggregates with visible separation of water from the aggregate during proportioning. At the time of batching, the free moisture content of fine aggregate must not exceed 8 percent of its saturated, surface-dry weight.

If the proportioning plant has separate supplies of the same size group of aggregate with different moisture content, specific gravity, or surface characteristics affecting workability, exhaust 1 supply before using another supply.

Cover rotating and reciprocating equipment on batch-mixer trucks with metal guards.

Individual cement delivery rate check-runs must not deviate more than 1.0 percent of the mathematical average of 3 runs of at least 1,000 pounds each.

When the water meter operates from 50 to 100 percent of production capacity, the indicated weight of water delivered must not differ from the actual weight delivered by more than 1.5 percent for each of 2 runs of 300 gallons. Calibrate the water meter under California Test 109. The water meter must be equipped with a resettable totalizer and display the operating rate.

Conduct calibration tests for aggregate, cement, and water proportioning devices with a platform scale located at the calibration site. Platform scales for weighing test-run calibration material must have a maximum capacity of 2.75 tons with maximum graduations of 1 pound. Error test the platform scale within 8 hours of calibrating the batch-mixer truck proportioning devices. Perform error-testing with test weights under California Test 109. Furnish a witness scale that is within 2 graduations of the test weight load. The witness scale must be available for use at the production site throughout the production period. Equipment needed for the calibration of proportioning systems must remain available at the production site throughout the production period.

The batch-mixer truck must be equipped so that accuracy checks can be made. Recalibrate proportioning devices every 30 days after production starts or when you change the source or type of any ingredient.

A spot calibration is calibration of the cement proportioning system only. Perform a 2-run spot calibration each time 55 tons of cement passes through the batch-mixer truck. If the spot calibration shows the cement proportioning system does not comply with the specifications, complete a full calibration of the cement proportioning system before you resume production.

Proportion liquid admixtures with a meter.

Locate cement storage immediately before the cement feeder. Equip the system with a device that automatically shuts down power to the cement feeder and aggregate belt feeder when the cement storage level is less than 20 percent of the total volume.

Submit aggregate moisture determinations, made under California Test 223, at least every 2 hours during proportioning and mixing operations. Record moisture determinations and submit them at the end of each production shift.

Equip each aggregate bin with a device that automatically shuts down the power to the cement feeder and the aggregate belt feeder when the aggregate discharge rate is less than 95 percent of the scheduled discharge rate.

Proportioning device indicators must be in working order before starting proportioning and mixing operations and must be visible when standing near the batch-mixer truck.

Identifying numbers of batch-mixer trucks must be at least 3 inches in height, and be located on the front and rear of the vehicles.

Mix volumetric proportioned RSC in a mechanically operated mixer. You may use auger-type mixers. Operate mixers uniformly at the mixing speed recommended by the manufacturer. Do not use mixers that have an accumulation of hard concrete or mortar.

Do not mix more material than will permit complete mixing. Reduce the volume of material in the mixer if complete mixing is not achieved. Continue mixing until a homogeneous mixture is produced at discharge. Do not add water to the RSC after discharge.

Do not use equipment with components made of aluminum or magnesium alloys that may have contact with plastic concrete during mixing or transporting of RSC.

The Engineer determines uniformity of concrete mixtures by differences in penetration measurements made under California Test 533. Differences in penetration are determined by comparing penetration tests on 2 samples of mixed concrete from the same batch or truck mixer load. The differences must not exceed 5/8 inch. Submit samples of freshly mixed concrete. Sampling facilities must be safe, accessible, clean, and produce a sample that is representative of production. Sampling devices and sampling methods must comply with California Test 125.

Do not use ice to cool RSC directly. If ice is used to cool water used in the mix, it must be melted before entering the mixer.

When proportioning and charging cement into the mixer, prevent variance of the required quantity by conditions such as wind or accumulation on equipment.

Each mixer must have metal plates that provide the following information:

1. Designed usage
2. Manufacturer's guaranteed mixed concrete volumetric capacity
3. Rotation speed

The device controlling the proportioning of cement, aggregate, and water must produce production data. The production data must be captured at 15-minute intervals throughout daily production. Each capture of production data represents production activity at that time and is not a summation of data. The amount of material represented by each production capture is the amount produced in the period from 7.5 minutes before to 7.5 minutes after the capture time. The daily production data must be submitted in electronic or printed media at the end of each production shift. The reported data must be in the order including data titles as follows:

1. Weight of cement per revolution count
2. Weight of each aggregate size per revolution count
3. Gate openings for each used aggregate size
4. Weight of water added to the concrete per revolution count
5. Moisture content of each used aggregate size
6. Individual volume of other admixtures per revolution count
7. Time of day
8. Day of week
9. Production start and stop times
10. Batch-mixer truck identification
11. Name of supplier
12. Specific type of concrete being produced
13. Source of the individual aggregate sizes
14. Source, brand, and type of cement
15. Source, brand and type of individual admixtures
16. Name and signature of operator

You may input production data by hand into a pre-printed form or it may be captured and printed by the proportioning device. Present electronic media containing recorded production data in a tab delimited format on a CD or DVD. Each capture of production data must be followed by a line-feed carriage-return with sufficient fields for the specified data.

### **Bond Breaker**

Place bond breaker between JPCP (RSC) and **LCBRS** layer.

If you use curing paper or polyethylene film, place it in a wrinkle free manner. Overlap adjacent sheets a minimum of 6 inches in the same direction as the concrete pour.

If you use curing compound or paving asphalt, before application remove foreign and loose materials remaining from slab removal.

If you use paving asphalt, do not add water before applying asphalt to the base surface. Apply the paving asphalt in one even application at a rate from 0.02 to 0.10 gallon per square yard over the entire base surface area. Do not place concrete pavement until the paving asphalt has cured.

If you use curing compound, apply it in 2 separate applications. Apply each application evenly at a rate from 0.07 to 0.11 gallon per square yard over the entire base surface area.

### **Spreading, Compacting, and Shaping**

You may use metal or wood side forms. Wood side forms must not be less than 1-1/2 inches thick. Side forms must be of sufficient rigidity, both in the form and in the connection with adjoining forms, that movement will not occur under forces from subgrading and paving equipment or from the pressure of concrete.

Side forms must remain in place until the pavement edge no longer requires the protection of forms. Clean and oil side forms before each use.

After you deposit the RSC on the subgrade, consolidate RSC with high-frequency internal vibrators. Consolidate adjacent to forms and across the full paving width. Place RSC as nearly as possible to its final position. Do not use vibrators for extensive shifting of RSC.

Spread and shape RSC with powered finishing machines supplemented by hand finishing.

After you mix and place RSC, do not add water to the surface to facilitate finishing. Use surface finishing additives as recommended by the manufacturer of the cement after their use is approved by the Engineer.

### **Joints**

Before placing RSC against existing concrete, place 1/4-inch thick commercial quality polyethylene flexible foam expansion joint filler across the original transverse and longitudinal joint faces and extend the excavation's full depth. Place the top of the joint filler flush with the top of the pavement. Secure joint filler to the joint face of the existing pavement to prevent the joint filler from moving during the placement of RSC.

### **Final Finishing**

If the Engineer determines by visual inspection the final texturing may not comply with the specifications for coefficient of friction, the Engineer tests to determine coefficient of friction. Open the pavement to traffic and allow 5 days after concrete placement for the Department to test for coefficient of friction. If pavement does not comply with the specifications for coefficient of friction, grind the pavement under Section 42-2, "Grinding," of the Standard Specifications. Perform grinding before sealing joints.

### **Curing Method**

Use the curing method recommended by the manufacturer of the cement for JPCP (RSC).

### **Concrete Pavement Removal**

When removing and replacing concrete, remove it to full depth and width.

### **Crack Treatment**

If cracks form that do not extend to the full depth of a slab, treat the cracks with a high molecular weight methacrylate resin under "Concrete Pavement Crack Treatment."

### **Removal and Replacement of Slabs Without Bar Reinforcement**

For full depth and partial length slab removal, saw cut the full depth and width.

Saw cut full slabs at the longitudinal and transverse joints. Saw cut partial slabs at joints and where the Engineer orders. You may make additional saw cuts within the removal area to facilitate slab removal or to prevent binding of the saw cut at the removal area's edge. Saw cut perpendicular to the slab surface.

Use slab lifting equipment with lifting devices that attach to the slab. After lifting the slab, paint the cut ends of dowels and tie bars.

Construct transverse and longitudinal construction joints between the new slab and existing concrete using dowel bars. For longitudinal joints, offset dowel bar holes from original tie bars by 3 inches. For transverse joints, offset dowel bar holes from the original dowel bars by 3 inches.

Drill holes and use chemical adhesive to bond the dowel bars to the existing concrete. Use an automated dowel bar drilling machine. Holes must be at least 1/8-inch greater than the dowel bar diameter. Clean the holes in compliance with the chemical adhesive manufacturer's instructions. Holes must be dry when you place chemical adhesive.

Immediately after inserting dowel bars into the chemical adhesive-filled holes, support the dowel bars and leave them undisturbed for the minimum cure time recommended by the chemical adhesive manufacturer.

Clean the faces of joints and underlying base from loose material and contaminants. Coat the faces with a double application of pigmented curing compound under Section 28-1.07, "Curing," of the Standard Specifications. For partial slab replacements, place preformed sponge rubber expansion joint filler at new transverse joints in compliance with ASTM D 1752.

### MEASUREMENT AND PAYMENT

If the Engineer accepts a test strip and it remains as part of the paving surface, the test strip is measured and paid for as jointed plain concrete pavement (rapid strength concrete), seal pavement joint, and seal isolation joint as the case may be.

The contract price paid per cubic yard for jointed plain concrete pavement (rapid strength concrete) as designated in the Verified Bid Item List includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the concrete pavement, complete in place including bond breaker, bar reinforcement, tie bars, dowel bars, anchors, and fasteners, as shown on the plans and as specified in these specifications and the special provisions, and as directed by the Engineer.

The Engineer adjusts payment for jointed plain concrete pavement (rapid strength concrete) in compliance with "Pay Factor Adjustment for Low Modulus of Rupture."

Repair, or removal and replacement of damaged pavement and base is at your expense and will not be measured or paid for.

Full compensation for providing a facility for and attending the prepaving conference is included in the contract price paid per cubic yard for jointed plain concrete pavement (rapid strength concrete) and no additional compensation is allowed therefor.

Full compensation for applying tack coat at transverse transition joints and end anchors is included in the contract price paid per cubic yard for jointed plain concrete pavement (rapid strength concrete) and no separate payment is made therefor.

If the curvature of a slab affects tie bar spacing and additional tie bars are required, they are included in the contract price paid per cubic yard for jointed plain concrete pavement (rapid strength concrete) and no additional compensation is allowed therefor.

## 10-1.52 PRECAST PRESTRESSED CONCRETE PAVEMENT

### GENERAL

#### Summary

This work includes constructing precast prestressed concrete pavement (PPCP).  
Comply with Section 40, "Concrete Pavement," of the Standard Specifications.

#### Definitions

**Panel:** Individual precast prestressed concrete pavement (PPCP) panel which connect with other PPCP panels to form a post-tensioned slab.

**Base panel:** a panel with no access or central stressing pockets.

**Joint panel:** a panel with a doweled expansion joint, elongated stressing pockets at third points, and access pockets for anchoring post-tensioning strand.

**Central stressing panel:** a panel with central stressing pockets for connecting and tightening post-tensioning strand.

**Slab:** a system of adjoining panels connected together with post-tensioning strand.

**Duct:** a horizontal tube in each panel transverse to prestress for alignment of post-tensioning strand.

**Access pocket:** a series of recessed holes in joint panels to anchor p post-tensioning strand.

**Central stressing pocket:** a series of elongated recessed holes in central stressing panels for connecting and tightening post-tensioning strand.

**Grout vents:** are vertical tubes that open at the panel surface and intersect ducts to allow for grouting of the post-tensioning strand within the ducts.

**Underslab grout vents:** are vertical tubes that open at the panel surface and intersect the bottom of the slab to allow for underslab grouting of the panels.

**Bonding Agent:** an agent applied to concrete surfaces prior to placing grout backfill to access and stressing pockets, dowel slots, and spall repairs.

**Bond breaker:** an agent applied to base and panel surfaces to prevent bonding of concrete and grout to them.

**Curing compound:** an agent applied to fresh grout and concrete surfaces to allow proper curing of the material.

**Final set time:** Time a specific penetration resistance of 4,000 psi is achieved, determined under ASTM C 403.

**Opening age:** Time the concrete and grout mixtures achieve the specified strength for opening to traffic.

## **Submittals**

Submit AASHTO T 336 coefficient of thermal expansion test results to the Engineer.

Submit Shop Drawings to the Engineer for approval. Include panel layout drawings. Comply with Section 5-1.02, "Plans and Working Drawings" of the Standard Specifications.

For rejected test strips, submit a plan for changed materials, methods, or equipment before constructing additional test strips.

## **Quality Control and Assurance**

### **General**

Perform coefficient of thermal expansion testing under AASHTO T 336 at a frequency of 1 test for each day of casting. Comply with "Precast Concrete Quality Control" and these special provisions.

Perform profilograph testing on concrete shoulders. Testing and test results must comply with the specifications for concrete pavement smoothness, profilograph test procedure, and corrective action for traffic lanes.

### **Prefabrication Conference**

Meet with the Engineer at a prefabrication conference at a mutually agreed time and place. Discuss all aspects of the work, including design, fabrication, installation and inspection.

Prefabrication conference attendees must sign an attendance sheet provided by the Engineer. The prefabrication conference must be attended by your:

1. Project superintendent
2. Quality control manager
3. Fabricator's construction foreman
4. Subcontractor's workers including:
  - 4.1. Fabricator's plant manager
  - 4.2. Fabricator's engineering manager
  - 4.3. Fabricator's Quality Control manager

Do not start fabrication activities until the listed personnel have attended a prefabrication conference.

### **Preinstallation Conference**

Two weeks before beginning installation activities, meet with the Engineer at a preinstallation conference at a mutually agreed time and place. Discuss methods of performing the installation work.

Preinstallation conference attendees must sign an attendance sheet provided by the Engineer. The preinstallation conference must be attended by your:

1. Project superintendent
2. Quality control manager
3. Installation construction foreman
4. Subcontractor's workers including:
  - 4.1. Fabricator's project manager
  - 4.2. Personnel responsible for saw cutting, epoxy application, posttensioning, fill access pockets, duct grouting, underslab grouting and joint sealing

Do not start precasting and installation activities including test strips until the listed personnel have attended a precasting and installation conference.

### **Test Strips**

The first installation activity must be to construct a test strip:

1. 700 to 1,000 feet long
2. Same width as the planned installation
3. With the same equipment used for the planned installation
4. Include a highest rate of superelevation transition

The Engineer evaluates the test strip for compliance with the specifications for Engineer's acceptance.

The test strip must demonstrate the installation does not leave voids, segregations, or surface irregularities such as depressions, dips, or high areas.

Allow the Engineer 3 days to evaluate the test strip for:

1. Smoothness
2. Surface friction
3. Panel alignment
4. Expansion joint width and seal
5. Final finishing of access pockets except coefficient of friction
6. Edge alignment and connection to existing pavement

Notify the engineer 25 days prior to installation of the test strip for the Department to schedule friction testing. During the 3-day evaluation, the Engineer rejects a test strip if:

1. Surface varies more than 0.02 foot from a 12-foot straightedge's lower edge
2. Wheel path's individual high points are greater than 0.025 foot in 25 feet
3. Panel alignment does not comply with specified placement tolerances
4. Expansion joint width deficiency is greater than 1/8<sup>th</sup> inch
5. Final finishing does not comply with the specifications except coefficient of friction
6. Deficiency of edge alignment and connection to existing pavement

Remove the test strip if the Engineer rejects it for noncompliance with the specifications for panel alignment. Dispose of rejected test strip material under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

If the Engineer rejects the test strip for noncompliance with the smoothness or final finishing specifications except coefficient of friction, you may grind the test strip into compliance if you intend to leave it as part of the pavement.

If the Engineer does not reject the test strip during the 3-day evaluation, you may begin production installation while the Engineer continues to evaluate the test strip for compliance with the other specifications. If the Engineer rejects the test strip for noncompliance with the other specifications, stop production installation until you construct a test strip the Engineer accepts.

Construct additional test strips until the Engineer accepts one.

Construct additional test strips if:

1. You propose different installation equipment including:
  - 1.1. Fabrication plant
  - 1.2. Panel delivery equipment
  - 1.3. Lifting devices
  - 1.4. Post tensioning devices
  - 1.5. Grouting equipment
  - 1.6. Connections to existing pavement
2. You change access pocket concrete mix proportions, or duct or underslab grout mix proportions

The Engineer may allow installation to start without a test strip if you use a fabrication plant, installation equipment, and personnel that completed a Department project within the preceding 12 months. Submit supporting documents and previous project information.

## **MATERIALS**

### **Concrete**

Add enough air-entraining admixture in compliance with Section 90-4, "Admixtures," of the Standard Specifications to attain an air content of  $4 \pm 1.5$  percent in the freshly mixed concrete.

Concrete for PPCP must have a minimum compressive strength of 6000 PSI at 28 days.

## **Bar Reinforcement and Prestressing Steel**

Bar reinforcement must be one of the following:

1. Epoxy coated steel reinforcing bar:
  - 1.1. Bar must comply with ASTM A 615/A 615M, Grade 40 or 60; ASTM A 996/A 996M; or ASTM A 706/A 706M.
  - 1.2. Epoxy-coating must comply with ASTM A 934/A 934M. Epoxy-coating must be purple or gray and handled at the manufacturing plant and job site under ASTM D 3963/D 3963M and Section 52-1.02B, "Epoxy-coated Reinforcement," of the Standard Specifications.
2. Low carbon, chromium steel bar:
  - 2.1. Low carbon, chromium steel bar must comply with ASTM A 1035/A 1035 M.

Bar reinforcement shall be Grade 60.

Transverse pretensioning strand shall be 0.5 inch diameter, conforming to ASTM Designation: A 416, Grade 270 (low relaxation).

Longitudinal post-tensioning strand shall be 0.6 inch diameter conforming to the requirements of ASTM Designation A 882.

Ducts must be galvanized conforming to the requirements for ducts in Section 50, "Prestressing Concrete," of the Standard Specifications.

Polyethylene sheeting between panels and lean concrete base rapid setting (LCBRS) must be 6 mils or thicker, and conform to the requirements of ASTM Designation C 171, white opaque.

Epoxy must comply with Section 95 of the Standard Specifications and these special provisions.

Polyester grout must comply with "Repair Spalled Joints (Polyester Grout)" and these special provisions.

Bonding agent for polyester grout must comply with the manufacturer's recommendations for the grout used.

Cementitious grout for prestressing steel in ducts and underslab grouting, must comply with Section 50-1.09, "Bonding and Grouting" of the Standard Specifications and these special provisions.

## **Dowel Bar**

Dowel bars must be one of the following:

1. Epoxy coated steel reinforcing bar:
  - 1.1. Reinforcing bar must comply with ASTM A 615/A 615M, Grade 40 or 60.
  - 1.2. Epoxy coating must comply with ASTM A 884/A 884M, Class A, Type 2. Epoxy coating must be purple or gray.
2. Stainless steel bar:
  - 2.1. Stainless steel bar must be descaled, pickled, and polished solid stainless steel bars, UNS Designation S31603 or S31803, Grade 60 under ASTM A 276/A 276M, and ASTM A 955/A 955M.

Dowel bars extending from the PPCP shall be Grade 60 epoxy coated or stainless steel and comply with these special provisions.

Dowel expansion sleeves must be stainless steel.

## **Tie Bar**

Tie bars must be one of the following:

1. Epoxy coated steel reinforcing bar:
  - 1.1. Bar reinforcing must comply with ASTM A 615/A 615M, Grade 40 or 60; ASTM A 996/A 996M; or ASTM A 706/A 706M
  - 1.2. Epoxy coating for deformed tie bars must comply with ASTM A 934/A 934M. Epoxy coating must be purple or gray.
  - 1.3. Epoxy coating for smooth tie bars and tie bar baskets must comply with ASTM A 884/A 884M, Class A, Type 2.

2. Stainless steel bar:
  - 2.1. Stainless steel bar must be descaled, pickled, and polished solid stainless steel bars UNS Designation S31603 or S31803, Grade 60 under ASTM A 955/A 955M
3. Low carbon, chromium steel bar:
  - 3.1. Low carbon, chromium steel bar must comply with ASTM A 1035/A 1035M.

**Joint Seal**

Use compression seal for construction joints.

**Joint Seal for Isolation Joints**

Use compression seal for longitudinal isolation joint.

**Joint Filler for Isolation Joints**

Joint filler for isolation joints must be bituminous expansion joint filler.

**Joint Seal for Expansion Joints**

Seal expansion joints with Type B preformed elastomeric joint seal as specified in Section 51, "Concrete Structures," of the Standard Specifications. Joint seal must accommodate a total movement of 1 inch. Follow the manufacturer's specifications for reservoir dimensions and installation width of the joint seal. Adjust the width of the expansion joint on-site based upon the approximate ambient temperature at panel installation according to:

Ambient Temperature (Ta*)	<200 foot Slab Length	>200 foot Slab Length
Ta < 60°F	1 inch	1-1/4 inch
59°F < Ta < 105°F	1/2 inch	3/4 inch
Ta > 105°F	1/4 inch	1/2 inch
* Do not install panels when Ta > 120°F		

**Tack Coat**

Tack coat must comply with Section 39, "Hot Mix Asphalt," of the Standard Specifications.

**CONSTRUCTION**

Fabricate panels to comply with the following:

TABLE OF ALLOWABLE TOLERANCES

Length (Longer dimension)	+/- 1/4 inch
Width (Shorter dimension)	+/- 1/8 inch
Nominal Thickness	+/- 1/16 inch
Edge alignment (straightness vs. camber and bow)	+/- 1/8 inch
Skew (Deviation of ends from shop plan dimensions)	+/- 1/8 inch
Batter	+/- 1/16 inch
Position of pre-tensioning strands	+/- 1/8 inch Vertical* +/- 1/8 inch Horizontal
Position of post-tensioning ducts at transverse joints	+/- 1/8 inch Vertical* +/- 1/8 inch Horizontal
Straightness of post-tensioning ducts (length of duct)	+/- 1/8 inch Vertical* +/- 1/4 inch Horizontal
Diagonal (difference of corner-corner measurement)	+/- 1/8 inch
Position of lifting anchors	+/- 3 inches
Note: *Measured from bottom of panel	

Grease the section of dowel extending into the expansion sleeve prior to casting.

Maintain alignment of post-tensioning ducts in forms during casting. Loose bar stiffeners may be used to maintain duct alignment during concrete placement

Locate grout vents in the joint panels and central stressing panels as shown on the panel detail sheets. Locate grout vents in the base panels as shown on the panel detail sheets at the mid-point of each duct.

Locate lifting devices approximately 0.2 X L from the panel edges as shown on the plans. Lifting devices must not protrude from the panel surface.

Do not cut or release pretensioning steel in PPCP panels until the concrete in the panel has a compressive strength of not less than 4000 PSI.

The top surface of the each panel shall be given a coarse texture by brooming with a stiff bristled broom or by other suitable devices that will result in uniform longitudinal texture, in advance of curing operations.

Cure concrete for PPCP in conformance with Section 90-7.04 “Curing Precast Concrete Members” of the Standard Specifications.

Repair panels damaged during removal from forms and handling with polyester grout. Repairs are required when the surface of the panel or the keyed panel edges are damaged and will affect ride quality, assembly of the panels, or long-term performance of the pavement. Repairs to keyways and adjoining panel edges must not protrude past the edge of the keyway and panel.

Place polyethylene sheeting in a wrinkle free manner on existing or reconstructed base prior to installing PPCP. Overlap adjacent sheets a minimum of 6 inches in the same direction as the panel installation.

Install panels to comply with the following:

TABLE OF ALLOWABLE INSTALLATION TOLERANCES

Vertical Differential	¼ inch at transverse joints ¼ inch at longitudinal joints
Horizontal Alignment	+/- 1/8 inch at transverse joints +/- 1/4 inch at longitudinal joints

Temporarily post-tensioned panels together during placement to ensure closure of transverse joints prior to final post-tensioning. The maximum jacking force must not exceed 0.75  $F_{pu}$ . Use elongated stressing pockets at third points of joint panels to accommodate the post-tensioning ram for temporary post-tensioning when placing panels between the joint panels and central stressing panels. Use pockets of central stressing pockets for temporary post-tensioning when placing panels between the central stressing panels and the next joint panel. Use 7-wire strand, 0.5 inch or 0.6 inch diameter for temporary post-tensioning. Perform temporary post-tensioning operations no less than every three panels. Prevent damage to the keyways during temporary post-tensioning.

Seal transverse joints between panels to prevent intrusion of water and corrosive agents with epoxy using one or both of the following methods:

- A. Slow-setting (4 hour set) epoxy resin adhesive for bonding new concrete to new concrete shall be applied to the entire surface of the keyed joints of adjacent panels. Do not apply epoxy within ½ inch of the duct openings.
- B. Inject epoxy into transverse joints after completion of post-tensioning and grouting to seal the joint from water intrusion.

Seal the post-tensioning ducts at the transverse joints to prevent grout leakage using one or both of the following methods:

- A. Place a compressible foam or neoprene gasket around each opening of post-tensioning ducts. The seal must be continuous, not compressible to a thickness less than 1/8 inch. Do not cover any part of the duct opening. Do not use any method or material to inhibit the flow of grout through the duct.
- B. Place a sleeve to extend from each post-tensioning duct to the next panel being placed. The sleeve must not inhibit insertion of the post-tensioning strands or inhibit the flow of grout through the duct.

Complete post tensioning of a slab no more than 3 days after placement of the panels and when the panels are opened to traffic prior to post-tensioning. If slow-setting epoxy is applied to the keyed panel joints, complete post-tensioning prior to the specified final set time of the epoxy, and no more than 24 hours after beginning of panel placement.

Fill access and central stressing pockets only after completion of post-tensioning and prior to grouting the post-tensioning tendons. Fill the pockets with polyester grout. Grout shall be thoroughly consolidated. Use accelerated strength grout if the finished precast prestressed concrete pavement is to be opened to traffic within 3 hours of filling. Finish the grout surface to match the surface of the surrounding panel. Repair grout shrinkage and surface cracks with high molecular weight methacrylate resin. Bonding agent for polyester grout must comply with the manufacturer’s recommendations for the grout used.

Fill access and central stressing pockets only after completion of post-tensioning and prior to grouting the post-tensioning tendons. Fill the pockets with Class 1 concrete produced from aggregate with a ½ inch, maximum grading. Concrete penetration shall be near the lower limit of the specified nominal penetration. Concrete shall be thoroughly consolidated. Use accelerated strength low shrink concrete if the finished precast prestressed concrete pavement is to be opened to traffic within 3 hours of filling. Finish the concrete surface to match the surface of the surrounding panel. Repair concrete shrinkage and surface cracks with high molecular weight methacrylate resin. Bonding agent if used for Class 1 concrete must comply with the manufacturer's recommendations for the concrete used.

If central stressing pockets and anchorage access pockets are unable to be filled prior to opening to traffic, close the pockets with temporary covers to withstand traffic loading. Fasten the temporary covers to the panels so they are not disturbed or dislodged by traffic and are flush with the surface of the pavement. Do not use other filler materials before final filling.

Grout the ducts after post-tensioning is complete and central stressing pockets and anchorage access pockets are filled. Complete grouting as soon as possible, but not more than 3 days, after completion of post-tensioning. Grouting may be completed prior to opening to traffic. Complete underslab grouting using the vents shown on the plans within 3 days after access and central stressing pockets are filled. Comply with materials and procedures in Section 41, "Pavement Subsealing and Jacking," except for the requirements for drilling holes, in Section 41-1.03. The Engineer determines if underslab-grouting must occur prior to opening to traffic, and when there are voids of ½ inch or greater beneath panels during placement. The Engineer orders sealing at exposed voids prior to underslab grouting to prevent grout leakage. Sealing must not affect the finished elevation of the pavement.

### **Bar Reinforcement in Curves**

For transverse bar reinforcement in a curve with a radius under 2,500 feet, place the reinforcement in a single continuous straight line across the lanes and aligned with the radius point. Place prestress on the same alignment as the transverse bar reinforcement. If the curve does not allow the specified spacing between transverse bar reinforcement and prestress, space them a distance that is between one half the specified spacing and the specified spacing.

### **Transition Joints With Hot Mix Asphalt**

If a joint between precast prestressed concrete pavement and hot mix asphalt is specified, apply tack coat between the precast prestressed concrete pavement and hot mix asphalt.

### **Concrete Pavement Removal**

When removing and replacing concrete, remove it to full depth and width.

### **Crack Treatment**

If cracks form that do not extend to the full depth of a panel, and at access pockets, treat the cracks with a high molecular weight methacrylate resin under "Concrete Pavement Crack Treatment."

### **Removal and Replacement of Concrete Pavement Without Bar Reinforcement**

For full depth and partial length concrete pavement removal, saw cut the full depth and width.

Saw cut full concrete pavement slabs at the longitudinal and transverse joints. Saw cut partial concrete pavement slabs at joints and where the Engineer orders. You may make additional saw cuts within the removal area to facilitate concrete pavement removal or to prevent binding of the saw cut at the removal area's edge. Saw cut perpendicular to the concrete pavement surface.

Use slab lifting equipment with lifting devices that attach to the concrete pavement to be removed. After lifting the concrete pavement to be removed, paint the cut ends of dowels and tie bars in the concrete pavement to remain.

Construct transverse and longitudinal construction joints between the precast prestressed concrete pavement and existing concrete as shown on the plans. For longitudinal joints, offset dowel bar holes from original tie bars by 3 inches. For transverse joints, offset dowel bar holes from the original dowel bars by 3 inches.

Use chemical adhesive to bond the dowel bars at connections between precast prestressed concrete pavement and the existing concrete. Holes must be at least 1/8-inch greater than the dowel bar diameter. Clean the holes in compliance with the chemical adhesive manufacturer's instructions. Holes must be dry when you place chemical adhesive.

Immediately after inserting dowel bars into the chemical adhesive-filled holes, support the dowel bars and leave them undisturbed for the minimum cure time recommended by the chemical adhesive manufacturer.

Clean the faces of joints and underlying base from loose material and contaminants. Coat the faces with a double application of pigmented curing compound under Section 28-1.07, "Curing," of the Standard Specifications.

## **Connections Between Precast Prestressed Concrete Pavement and Existing Concrete Pavement**

Install dowel bars at connections between precast prestressed concrete pavement and existing pavement as shown on the plans. Comply with "Retrofit Existing Concrete Pavement with Dowel Bars at Transverse Joints" of these special provisions.

Install dowel bars extending from the PPCP in the existing and cast-in-place pavement as shown on the plans.

Fill dowel bar slots in the existing concrete pavement as soon as possible after panel placement and prior to opening to traffic. Fill dowel bar slots with polyester grout. Bonding agent for polyester grout must comply with the manufacturer's recommendations for the grout used.

### **MEASUREMENT AND PAYMENT**

Precast prestressed concrete pavement as designated in the Verified Bid Item List will be measured by the cubic yard.

If the Engineer accepts a test strip and it remains as part of the precast prestressed concrete pavement surface, the test strip is measured and paid for as precast prestressed concrete pavement (PPCP), seal pavement joint, and seal isolation joint as the case may be.

The contract price paid per cubic yard for precast prestressed concrete pavement as designated in the Verified Bid Item List includes full compensation for furnishing all labor, approved shop drawings, testing, materials (including bar reinforcement and pre-stressing steel), bond breaker, tie bars, dowel bars, anchors, and fasteners, lifting anchors, temporary and final post-tensioning steel, chemical adhesive, epoxy, tools, equipment, and incidentals, and for doing all the work involved in constructing, furnishing, transporting and installing the precast prestressed concrete pavement, complete in place as shown on the plans and as specified in the Standard Specifications, these special provisions, and as directed by the Engineer.

Full compensation for furnishing, placing, and maintaining temporary covers and polyester grout in access and stressing pockets, furnishing and placing gaskets, sleeves and grout in ducts, furnishing and placing underslab sealant and grout is included in the contract price for cubic yard for precast prestressed concrete pavement and no additional compensation is allowed.

Repair, or removal and replacement of damaged existing pavement, asphalt concrete, existing and replacement base, and precast prestressed concrete pavement is at your expense and will not be measured or paid for.

Full compensation for providing a facility for and attending the prepaving conference is included in the contract price paid per cubic yard for precast prestressed concrete pavement (PPCP) and no additional compensation is allowed therefor.

Full compensation for applying tack coat at transverse transition joints and end anchors is included in the contract price paid per cubic yard for precast prestressed concrete pavement (PPCP) and no separate payment is made therefor.

Full compensation for applying paint to the cut ends of dowels and tie bars in the concrete pavement to remain is included in the contract price paid per cubic yard for precast prestressed concrete pavement (PPCP) and no separate payment is made therefor.

If the curvature of a slab affects bar reinforcement and prestress spacing and additional bar reinforcement and prestress is required, they are included in the contract price paid per cubic yard for precast prestressed concrete pavement (PPCP) and no additional compensation is allowed therefor.

### **10-1.53 SEAL LONGITUDINAL ISOLATION JOINTS**

#### **GENERAL**

Sealant for longitudinal isolation joint shall be compression seal and placed in accordance with the requirements.

Prior to placing concrete, joint filler material shall be placed as shown on the plans. The joint filler shall be secured to the face of the existing pavement joint face by a method that will hold the joint filler in place during placement of concrete.

#### **Preformed Compression Joint Sealant**

Preformed compression seals shall conform to the requirements of ASTM Designation: D 2628. All preformed compression seals shall have 5 or 6 cells. Lubricant adhesive used with preformed compression seals shall conform to the requirements of ASTM Designation D 2835. Compression seals along with lubricant adhesive shall be installed in conformance with the manufacturer's recommendations. The manufacturer's recommendations shall be submitted to the Engineer at the prepaving conference.

Each lot of compression seal and lubricant adhesive shall be accompanied by a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications, and shall be accompanied with storage instructions and precautionary instructions for use. The Contractor shall also submit the manufacturer's data sheet with installation instructions and recommended model or type of preformed compression seal for the joint size and depth as shown on the plans. The manufacturer's selected compression seal shall show evidence that the seal is being compressed at level between 20 and 50 percent at all times for the joint width and depth shown on the plans.

## **MEASUREMENT AND PAYMENT**

The contract price paid per linear foot for seal longitudinal isolation joint shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in sealing longitudinal isolation joints complete in place, including sawing, cleaning and preparing the joints in the concrete pavement, furnishing and installing, compression seal, joint filler material, repairing and patching spalled or raveled sawed joints, and replacing or repairing rejected joints, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

### **10-1.54 RETROFIT EXISTING CONCRETE PAVEMENT WITH DOWEL BARS AT TRANSVERSE JOINTS**

#### **GENERAL**

Install epoxy-coated round steel dowel bars in existing concrete pavement at transverse weakened plane joints at the locations shown on the plans and as provided in these special provisions.

#### **PRECONSTRUCTION CONFERENCE (DOWEL BAR RETROFIT)**

Supervisory personnel of the Contractor and any subcontractor who are to be involved in the slot cutting and dowel bar placement work shall meet with the Engineer at a preconstruction conference, at a mutually agreed time and location, to discuss methods of accomplishing all phases of the work.

The Contractor shall provide a facility for the conference. The facility shall be within 3 miles of the construction site or at a nearby location agreed to by the Engineer and Contractor. Attendance at the conference is mandatory for the project superintendent, construction foreman, subcontractors and equipment operators involved in cutting slots or placing dowel bars. All conference attendees shall sign an attendance sheet provided by the Engineer. Cutting of slots and placement of dowel bars shall not proceed unless the above-mentioned personnel have attended the conference.

The above-mentioned personnel along with the Engineer's representatives shall attend a 4-hour training class on dowel bar placement techniques as part of the preconstruction conference. This training class time shall be in addition to the conference time. The class shall be scheduled no more than 2 weeks prior to the placement of dowel bars. The class shall be held during normal working hours. Selection of the instructor shall be as agreed to by the Engineer and the Contractor.

The training class may be waived if the Contractor can provide written verification of prior acceptable work experience and training involving the placement of dowel bars in existing concrete pavement.

#### **TEST STRIP**

The Contractor shall retrofit dowel bars, including concrete removal, placing fast setting polyester grout, and pavement grinding, in an initial test strip of precast prestressed concrete pavement at a site directed by the Engineer prior to the start of major operations. The test strip shall be the same width and at the same locations where the precast prestressed concrete pavement connects to the existing concrete pavement. Twenty-four hours after the completion of the dowel bar placement and the filling of the slots with fast setting grout, the Contractor shall take 3 full depth cores, at 3 separate joint locations directed by the Engineer to determine the completeness of the removal and installation operations. Core drilling shall conform to the requirements in these special provisions. If the results of the test strip conform with the plans and specifications, the Contractor may begin production operations using the methods and materials used in the test strip, and shall proceed on a performance basis. The working days for the test strip shall be considered as part of the total contract time.

#### **MATERIALS**

##### **Dowel Bars**

Dowel bars shall be plain, smooth, round, epoxy-coated steel conforming to the requirements in ASTM Designation: A 615/A 615M, Grade 60, the details shown on the plans and the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement," of the Standard Specifications, except that the two samples required in ASTM Designation: D 3963/D 3963M shall be 18 inches long. Epoxy coating of dowel bars shall conform to the provisions in ASTM Designation: A 884/A 884M, Class A, Type 1 or Type 2, except that the bend test shall not apply.

Dowel bars shall be free from burrs or other deformations detrimental to free movement of the bars in the concrete.

##### **Bond Breaker**

Dowel bars shall be coated with a bond breaker over the entire bar. The bond breaker shall be manufactured as a release agent for polyester resin.

### **Expansion Cap**

Expansion caps shall be tight fitting, commercial quality nonmetallic, nonorganic material that will allow a minimum of 1/4 inch of movement at each end of the bar.

### **Caulking Filler**

Caulking filler used for sealing the transverse joint at the bottom and sides of the dowel bar slot shall be a silicone caulk containing a minimum of 50 percent silicone and designated as a concrete sealant. Caulking filler shall conform to the requirements of ASTM Designation: C 834.

### **Foam Core Insert**

The foam core insert shall be closed cell foam faced with poster board material or plastic faced material on each side, or rigid styrofoam material capable of remaining in a vertical position and tight to all edges during the placement of the fast setting polyester grout.

### **Dowel Bar Support Chairs**

Chairs for supporting the dowel bars shall be either completely epoxy-coated steel conforming to the requirements of ASTM Designation: A 884/A 884M or shall be fabricated of commercial quality nonmetallic, nonorganic material. The dowel bar support chairs shall firmly hold the dowel bars centered in the slots during fast setting grout backfill operations. Dowel bar supports shall be designed to hold the bar a minimum of 1/2 inch above the bottom of the slot while the fast setting polyester grout backfill is placed and consolidated.

### **Fast Setting Polyester Grout**

Fast setting polyester grout must comply with "Repair Spalled Joints (Polyester Grout)" and these special provisions. Use sufficient resin in the polyester grout so that after consolidation some resin visibly bleeds to the surface.

Clean, uniform rounded aggregate filler may be used to extend the polyester grout. The extension of grout shall not exceed 60 percent of the weight of the grout or the maximum amount of grout extension recommended by the manufacturer, whichever is less. The moisture content of the aggregate filler shall not exceed 0.5 percent. Grading of the aggregate filler shall conform to the following:

Sieve Size	Percentage Passing
3/8"	100
No. 16	0-5

The amount of aggregate filler shall conform to the manufacturer's recommendation, but in no case shall the grout strengths be less than specified in these special provisions. The quantity of liquid activator for dual component type, to be blended with the dry component shall be within the limits recommended by the manufacturer and shall be the least amount required to produce a pourable batter.

Addition of accelerators and retarders, when required, shall be in conformance with the manufacturer's recommendations.

### **DOWEL BAR RETROFIT**

Dowel bars shall be installed in existing portland cement concrete pavement where it connects to the precast prestressed concrete pavement as shown on the plans and as specified in these special provisions.

### **Saw Cutting**

Two saw cuts shall be made in the existing portland cement concrete pavement to outline the longitudinal sides of each dowel bar slot. The outline of the longitudinal sides of the each dowel bar slot shall be sawn to the depth and length shown on the plans to place the center of the dowel bar at mid-depth in the pavement slab. The saw cuts for the dowel bar slots shall be parallel with each other and to the centerline of the roadway with a maximum tolerance of 1/4 inch. Saws shall be equipped with gang mounted diamond blades to provide the desired saw cut spacing and shall be capable of making 8 saw cuts for 4 dowel bar slots simultaneously. A minimum of 4 dowel bar slots in each wheel path will be required. Skewed joints or cracks may require slots longer than those shown on the plans. No additional compensation will be made for additional length or any component of the dowel bar retrofit beyond the limits shown on the plans. Pickup and removal of debris concrete, water residue, or paste from saw cutting shall be immediate. Pickup and removal shall include the use of a high powered, mobile, vacuum-cleaning machine capable of removing all displaced material with a minimum of dust.

Once the saw cutting operation to outline the longitudinal sides of the dowel bar slots has been completed for any work shift, the concrete remaining between the saw cuts shall be removed and replaced with dowel bar retrofit assembly and grout in place before opening to traffic.

### **Concrete Removal**

Concrete removal operations and the equipment used to remove the concrete remaining between the saw cuts shall not damage the pavement to remain. Jack hammers greater than 30-pound class shall not be used. If the concrete removal operations cause damage to the pavement that is to remain, the concrete removal operations shall be discontinued, and shall not resume until the Contractor has taken corrective measures. Damage to the concrete to remain shall be repaired or replaced at the Contractor's expense.

After removal of large concrete pieces by jack hammering, a small hammerhead shall be used to chip off rocks and burrs from the slot bottom to produce a level surface for the dowel bar support chairs to sit.

Operations shall be scheduled so that the concrete removed during a work shift to shape the dowel bar slots, shall be replaced, in that same work shift, with dowel bars and fast setting polyester grout, prior to the time the lane is to be opened to public traffic. In the event the concrete is removed to place the dowel bars and you are unable to place the dowel bars and fast setting polyester grout and cure the grout by the time the lane is to be opened to public traffic, fill the slot with a temporary backfill. Do not leave any slot unfilled prior to opening to traffic.

### **Temporary Backfill**

A sufficient standby quantity of cementitious material shall be provided at the project site for placement of temporary backfill in slots where existing pavement is being dowel bar retrofitted. The temporary backfill shall be maintained and later removed as a first order of work when the Contractor places the dowel bar and fast setting grout and cures the grout within the specified time limit. Do not use hot mix asphalt for temporary backfill.

The temporary backfill shall be produced from commercial quality aggregates and cementitious material. The grading of the aggregate shall conform to the 3/8-inch grading for in Section 40-2.09, "Hydraulic Cement Grout (Non-Shrink)," of the Standard Specifications.

Prior to placing temporary backfill, building paper shall be placed against all surfaces of the dowel bar slot to facilitate subsequent removal of the temporary backfill. Cementitious material for the temporary backfill shall be placed and consolidated by methods that will produce a well-compacted backfill with a surface of uniform smoothness, texture, and density. The finished surface of the backfill shall match the elevation of the existing concrete pavement.

The material from the removed temporary backfill shall be disposed of in conformance with Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications. When no longer required, standby backfill material shall be removed and disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13.

### **Slot Cleaning and Preparation**

Exposed surfaces in the dowel bar slot shall be cleaned by sand blasting to remove debris and to clean surfaces such that clean aggregate is exposed. Where sand blasting operations are being performed within 10 feet of a lane occupied by public traffic, the residue, including dust, shall be removed immediately after contact between the sand and the surface being treated. Removal shall be by a vacuum attachment operating concurrently with the sand blasting operation. Debris, excess moisture or residue in the dowel bar slot shall be vacuumed prior to bar installation.

Immediately after vacuuming all debris from the dowel bar slot, the slots shall be cleaned with moisture-free, oil-free compressed air having a minimum pressure of 90 pounds per square inch.

### **Seal Joints and Cracks in Slot**

The Contractor shall seal the existing transverse joint at the bottom and the sides of the dowel bar slot with caulking filler. The surfaces to receive caulking filler shall be clean and dry at the time the caulking filler is placed. Caulking filler shall be placed to a minimum of 1/2 inch beyond the edges of the slot in the existing transverse joint. The portion of any remaining saw cuts in the bottom of the slot which is deeper than the limits shown on the plans for concrete removal and within 6 inches of the existing transverse joint shall be filled with caulking filler. Any cracks exposed within the slot during concrete removal operations shall also be filled with caulking filler.

### **Placing Dowel Bars in Slots**

Dowel bar surfaces shall be cleaned prior to application of the bond breaker. The dowel bars shall be lightly coated with curing compound or factory applied paraffin lubricant prior to placement. The Contractor shall not allow the curing compound, when used, to drip onto the slot walls or bottom. The dowel bar support chair shall provide a minimum of 1/2 inch clearance between the bottom of the dowel bar and the bottom of the slot. The dowel bars shall be placed to the depth shown on the plans, parallel to the traffic lane centerline and the top of the pavement surface, and at the middle of the slot width within a tolerance of 1/4 inch. Dowel bars shall be centered at the transverse joint, such that not less than 8 inches and not more than 10 inches of the dowel bar extend into each adjacent panel. The dowel bar support chairs shall hold the dowel bar securely in place during placement of the fast setting polyester grout.

The foam core insert shall be placed at the middle of the dowel bar to maintain the transverse weakened plane joint. The existing joint sealant, if any, shall be removed to accommodate the 1/4 inch to 1/2 inch thick foam core insert. Two 1/2" x 1/2" tabs to stabilize the foam core insert during backfilling with fast setting polyester grout shall be used. The foam core insert shall be capable of remaining in a vertical position and tight to all edges during the placement of the fast setting polyester grout.

### **Mixing Fast Setting Grout**

Fast setting polyester grout shall be mixed in accordance with the manufacturer's instructions and these special provisions.

### **Placing Fast Setting Polyester Grout**

The Contractor shall fill each dowel bar slot with fast setting polyester grout with the installed dowel bar, expansion caps, support chairs, foam core insert, and caulking filler in place. Apply bonding agent prior to filling slot. The grout shall be vibrated with a small hand held vibrator capable of thoroughly consolidating the grout material into the slot and around the dowel bars and dowel bar support chairs. All grout shall be placed while fresh, and before the grout has taken an initial set.

The surface temperature of the areas to receive the grout shall be 40° F or above when grout is placed. Methods that are proposed to heat surfaces are subject to approval by the Engineer. The contact surfaces to receive polyester grout shall be dry prior to applying bonding agent.

### **Finishing Grout**

The surface of backfilled dowel bar slots shall be rounded 1/8 inch  $\pm$  1/32 inch above the existing concrete surface, which shall be removed during subsequent grinding work.

### **Curing Grout**

Fast setting polyester grout shall be cured in conformance with the manufacturer's instructions. Attention is directed to "Allowing Traffic over Dowel Bar Retrofitted Pavement," in these special provisions regarding grout curing time and strength gain requirements.

### **Grind Pavement**

Retrofit pavement lanes shall be ground, conforming to smoothness and finishing provisions in Section 42, "Groove and Grind Pavement," of the Standard Specifications and these special provisions. Pavement grinding shall be preformed prior to sawing and sealing the transverse weakened plane joints within the retrofit lanes.

Dowel bar retrofitted transverse joints shall be ground smooth within 30 days from the initial saw cutting for the dowel bar slots. The width of the pavement lane, longitudinal joint to longitudinal joint, shall be ground. All fast setting polyester grout backfilled into the dowel bar slots shall have a minimum cure time of 12 hours before grinding.

## **JOINT SEALING**

Transverse weakened plane joints within the retrofit lanes, longitudinal joint to longitudinal joint, shall be sealed as specified in this section and as shown on the plans.

Other joint sealing work shall be completed as specified elsewhere in these special provisions and as shown on the plans.

### **Removing Existing Seals**

Existing seals, if any, within the transverse joints of the dowel bar retrofit lane, shall be removed by manual removal, sawing, plowing or cutting. The Contractor shall propose the method of removal to the Engineer for approval 7 days before actual seal removal. No seal removal by the Contractor shall take place until the Engineer approves the seal removal method. Only rectangular plows shall be allowed if plowing method is used. Any removal method selected shall not damage the pavement that is to remain.

### **Shape Sealant Reservoir**

The transverse joints of the dowel bar retrofit lane shall be saw cut to form a seal reservoir as shown on the plans.

### **Joint Spalling Repair**

Minor spalling along joint faces shall be repaired in conformance with "Repair Spalled Joints (Polyester Grout)" of these special provisions.

### **Cleaning the Joint**

The joint shall be cleaned of any dust, dirt, or visible traces of old seals. Chemical solvents shall not be used to wash the joint. Immediately after sawing, plowing or cutting, or manual removal, any slurry or remaining debris from the removal operations shall be removed. The cleaning operation shall be performed in one direction to minimize contamination of surrounding areas. Surface moisture shall be removed at the seal reservoir by means of compressed air or moderate hot compressed air or other means approved by the Engineer. Drying procedures that leave a residue or film on the reservoir wall shall not be used. After reservoir drying, the reservoir shall be sandblasted to remove any remaining residue. Sandblasting straight into the reservoir will not be allowed. The sandblast nozzle shall be pointed close to the surface at an angle to clean each reservoir face. A minimum of one pass along each reservoir face shall be made. The reservoir shall then be air blasted to remove sand, dirt, and dust, no more than one hour before placement of seal. Compressed air used to air blast the reservoir shall not introduce oil into the reservoir. If oil is accidentally introduced into the reservoir, the Contractor shall begin the cleaning process again until the Engineer is satisfied that the reservoir is clean. Compressed air shall be delivered at a minimum rate of 120 cubic feet per minute and develop at least 90 pounds per square inch nozzle pressure. A vacuum sweeper shall be used to remove all debris or contaminants from the surrounding pavement surfaces after air blasting.

### **Cleanness Inspection**

Before installing seal, the reservoir sidewalls shall be checked for cleanness by the Engineer. The Engineer shall check for dirt and dust by finger wiping the sidewalls. If any traces of contamination are found, the Contractor shall reclean the joint.

### **Joint Seal Installation**

The reservoir walls shall be dry before installing the joint seal. Joints shall have the seal recessed below the final finished surface as shown on the plans.

After each joint is sealed, all surplus joint material on the pavement surface shall be removed. Traffic will not be permitted over the sealed joints until the seal is set sufficiently to prevent embedment of roadway debris into the seal.

Any failure of the joint material in either adhesion or cohesion of the material will be cause for rejection of the joint. The finished surface of joint seal shall conform to the dimensions and allowable tolerances shown on the plans. Rejected joint materials or joint material whose finished surface does not conform to the dimensions shown on the plans, shall be repaired or replaced, at the Contractor's expense, with joint material that conforms to the requirements.

Removed material or material generated by the Contractor's operations shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

### **Core Drilling for Dowel Bar Placement Alignment Assurance Testing**

Coring, to confirm dowel bar placement, shall be provided by the Contractor. Immediately after coring, the concrete cores shall be identified by the Contractor with a location description and submitted to the Engineer for inspection. The holes shall be cored by methods that will not shatter or damage the concrete adjacent to the holes.

After removal of cores, core hole voids in concrete pavement shall be cleaned and filled with fast setting polyester grout as specified under "Materials," of this section.

After placement of fast setting polyester grout in the core hole, trowel the grout to match the pavement surface. The polyester grout material shall not evidence any depressions or surplus material above the level surface of the pavement.

Water for core drilling operations shall be from a local domestic water supply. Water used for coring shall not contain more than 1,000 parts per million of chlorides as Cl, nor more than 1,300 parts per million of sulfates as SO<sub>4</sub>, nor contain any impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

Water from core drilling operations shall not be permitted to fall on public traffic, to flow across shoulders or lanes occupied by public traffic, or to flow into gutters or other drainage facilities.

The Engineer will randomly check dowel bar positioning by coring. Retrofitting will be checked by the Engineer within 4 days by performing one test for every 600 dowel bars placed. One test shall consist of drilling 2 cores, one on each end of a dowel bar to expose both ends and allow measurement for proper alignment. If the dowel bars are located incorrectly or air voids exist surrounding the dowel bars, additional cores will be required to determine the severity. Two additional cores shall be provided, at the Contractor's expense, for every one core that is misaligned or poorly consolidated. The Engineer will select the location for performing any additional core testing.

Dowel bar alignment shall meet the specified tolerances. If at any time dowel bars are found to be installed improperly, the dowel bar retrofitting operations will be suspended and operations shall not begin until the Contractor has demonstrated to the Engineer that the problem which caused the improper dowel bar positioning has been corrected. In addition, all dowel bars identified as not in alignment or damaged, shall be removed and replaced at the Contractor's expense.

**Allowing Traffic over Dowel Bar Retrofitted Pavement**

Unless otherwise permitted in writing by the Engineer, traffic shall not be permitted on dowel bar retrofitted pavement until the fast setting polyester grout attains:

- A. Curing of two hours after final set, or
- B. A compressive strength of 3,000 pounds per square inch or greater is achieved per ASTM Designation: C 109, or
- C. A flexural strength of 350 pounds per square inch or greater is achieved per California Test 523.

Final set determination for the fast setting polyester grout shall be in conformance with the requirements of ASTM Designation: C 403.

**MEASUREMENT AND PAYMENT**

The quantity of dowel bar retrofit to be paid for will be measured as units as determined from actual count in place.

The contract unit price paid for dowel bar retrofit shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in placing dowel bar retrofit, complete in place, including placing test strip, repairing any damaged or removed pavement delineation, cutting, blast cleaning, caulking, joint filler, grout backfill, sealing transverse weakened plane joints, and disposal of removed concrete, as shown on the plans, and as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for furnishing, stockpiling, and disposing of standby material for dowel bar slot temporary backfill; and for placing, maintaining, removing, and disposing of temporary backfill shall be considered as included in the contract unit price paid for dowel bar retrofit and no separate payment will be made therefor.

Full compensation for providing the facility, Contractor personnel and all the work involved in arranging for the preconstruction conference shall be considered as included in the contract unit price paid for dowel bar retrofit and no additional compensation will be allowed therefor.

The costs involved in providing an instructor at the 4-hour training class as part of the preconstruction conference will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications except that if payment is made by force account as provided in Section 9-1.03, "Force Account Payment," of the Standard Specifications, no markups will be allowed.

**10-1.55 CONCRETE PAVEMENT JUST-IN-TIME-TRAINING**

**GENERAL**

**Summary**

Your personnel required to attend the prepaving conference must also complete Just-In-Time-Training (JITT). JITT is a formal training class for the following pavement types:

Pavement Types for JITT
Jointed Plain Concrete Pavement (Rapid Strength Concrete)
Precast Panel Concrete Pavement (Prestressed)
Jointed Plain Concrete Pavement
Lean Concrete Base Rapid Setting
Repair Spalled Joints (Polyester Grout)
Concrete Pavement Crack Treatment

### **Submittals**

At least 7 business days before JITT, submit the instructor's name and listed experience, the JITT facility's location, and 1 copy each of the course syllabus, handouts, and presentation materials.

The Engineer provides training evaluation forms and each attendee must complete them. 5 business days after JITT, submit completed training evaluation forms to the Engineer and to:

Construction\_Engineering\_HQ@dot.ca.gov

### **Just-In-Time-Training**

JITT must be:

1. At least 4 hours long
2. At your option, an extension of the prepaving conference
3. Conducted within 3 miles of the job site
4. Completed at least 20 days before you start paving activities
5. Conducted during normal working hours

Provide a JITT instructor who is experienced with the specified pavement construction methods, materials, and tests. The instructor must be neither your employee nor a Department field staff member. Upon JITT completion, the instructor must issue a certificate of completion to each participant.

The Engineer may waive training for personnel who have completed equivalent training within the 12 months preceding JITT. Submit certificates of completion for the equivalent training.

### **MEASUREMENT AND PAYMENT**

The Engineer determines the costs for providing JITT under Section 9-1.03, "Force Account Payment," of the Standard Specifications, except no markups are added and you are paid for one half of the JITT cost. Costs for providing JITT include training materials, class site, and the JITT instructor including the JITT instructor's travel, lodging, meals and presentation materials. The Engineer does not pay your costs for attending JITT.

### **10-1.56 GRIND CONCRETE PAVEMENT**

This work shall consist of grinding concrete pavement as shown on the plans, as specified in Section 42-2, "Grinding," of the Standard Specifications and these special provisions, and as directed by the Engineer.

Grinding equipment for grinding concrete pavements shall use diamond blades mounted on a self-propelled machine designed for grinding and texturing concrete pavements. Grinding equipment that causes raveling, aggregate fracturing, or spalling, or that damages the transverse or longitudinal joints shall not be used.

Grinding shall be performed in the longitudinal direction of the traveled way and shall be done full lane width so that the grinding begins and ends at lines perpendicular to the pavement centerline.

Grinding of existing concrete adjacent to new concrete pavement shall be performed prior to placing the new concrete pavement. This does not apply to individual slab replacement.

Grinding concrete pavement shall result in a parallel corduroy texture consisting of grooves 0.08-inch to 0.12-inch wide with 55 grooves to 60 grooves per foot width of grinding. Tops of ridges shall be between 0.06-inch and 0.08-inch from the bottom of the blade grooves.

The ground surface at transverse joints or cracks will be tested with a 12-foot  $\pm 2-1/2$  inches long straightedge laid on the pavement parallel with the centerline with its midpoint at the joint or crack. The surface shall not vary by more than 0.01-foot from the lower edge of the straightedge.

Cross-slope uniformity and positive drainage shall be maintained across the entire traveled way and shoulder. The cross-slope shall be uniform so that when tested with a 12-foot  $\pm 2-1/2$  inches long straightedge placed perpendicular to the centerline, the ground pavement surface shall not vary more than 1/4 inch from the lower edge of the straightedge.

After grinding has been completed, the pavement surface shall be profiled in conformance with the requirements of Section 40-1.03, "Quality Control and Assurance," of the Standard Specifications. Two profiles shall be obtained in each lane approximately 3 feet from the lane lines. The average profile index shall be determined by averaging the two profiles in each lane. Additional grinding shall be performed, where necessary, to bring the ground pavement surface within the Profile Index requirements specified in Section 40-1.03, "Quality Control and Assurance," of the Standard Specifications.

Full compensation for profiling the ground pavement surface with a California profilograph or equivalent and any necessary additional grinding to bring the finished surface within the specified tolerances and for furnishing final profilograms to the Engineer shall be considered as included in the contract price paid per square yard for grind concrete pavement and no additional compensation will be allowed therefor.

## 10-1.57 CONCRETE PAVEMENT CRACK TREATMENT

### GENERAL

#### Summary

This work includes applying a high molecular weight methacrylate (HMWM) resin system to concrete pavement surface cracks that do not extend the full slab depth. HMWM resin system consists of:

1. HMWM resin
2. Promoter
3. Initiator

HMWM is not to be applied to any cracks in continuously reinforced concrete pavement.

#### Submittals

Before starting crack treatment, submit the following plans under the specifications for working drawings in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications:

1. Public safety plan for HMWM resin system
2. Placement plan for the construction activity
3. Material Safety Data Sheet for each component of the HMWM resin system

The public safety plan and the placement plan must identify materials, equipment, and methods to be used. The public safety plan must include details for:

1. Shipping
2. Storage
3. Handling
4. Disposal of residual HMWM and the containers

The placement plan must include:

1. Crack treatment schedule including coefficient of friction testing
2. Methods and materials including:
  - 2.1. Equipment description for HMWM resin system application
  - 2.2. Equipment description for sand application
  - 2.3. Gel time range and final cure time for resin

Revise rejected plans and resubmit. With each plan rejection, the Engineer gives revision directions including detailed comments in writing. The Engineer notifies you of a plan's acceptance or rejection within 2 weeks of receiving that plan. Submit HMWM samples 20 days before use.

#### Quality Control and Assurance

Before starting crack treatment, treat a 500-square foot test area within the project limits and at a location accepted by the Engineer. Use test areas outside the traveled way if available. Weather and pavement conditions during the test crack treatment must be similar to those expected during production crack treatment. Use equipment during testing similar to those to be used during crack treatment.

For the test area and during crack treatment, use test tiles for evaluating the HMWM resin system cure time. Coat at least one 4" x 4" smooth glazed tile for each batch of HMWM resin system. Place the coated tile adjacent to the area being treated. Do not apply sand to the test tiles.

Do not start crack treatment until the Engineer accepts the test area.

The Engineer accepts a treated area if:

1. The corresponding test tiles are dry to the touch
2. The treated surface is tack-free and non-oily
3. The sand cover adheres enough to resist hand brushing
4. You remove excess sand
5. The coefficient of friction is at least 0.30 determined under California Test 342

## MATERIALS

Promoter and initiator in the HMWM resin system must be compatible. The HMWM resin may be a prepromoted resin consisting of promoter and resin mixed together before filling containers. Identify prepromoted resin on the container label.

The resin gel time must be from 40 to 90 minutes at the application temperature. Adjust the gel time to compensate for temperature changes throughout the application.

HMWM resin must comply with:

### High Molecular Weight Methacrylate Resin

Property	Requirement	Test Method
Viscosity <sup>a</sup>	25 cP, maximum, (Brookfield RVT with UL adapter, 50 RPM at 77 °F)	ASTM D 2196
Specific Gravity <sup>a</sup>	0.90 minimum, at 77 °F	ASTM D 1475
Flash Point <sup>a</sup>	180 °F, minimum	ASTM D 3278
Vapor Pressure <sup>a</sup>	1.0 mm Hg, maximum, at 77 °F	ASTM D 323
Tack-free Time	400 minutes, maximum, at 77 °F	Specimen prepared under California Test 551
Volatile Content <sup>a</sup>	30 percent, maximum	ASTM D 2369
PCC Saturated Surface-Dry Bond Strength	500 psi, minimum at 24 hours and 77 °F±2 °F	California Test 551

Note:

<sup>a</sup> Test must be performed before adding initiator.

Sand must be commercial quality dry blast sand. At least 95 percent of the sand must pass the No. 8 sieve and at least 95 percent must be retained on the No. 20 sieve.

## CONSTRUCTION

Apply HMWM resin system after any grinding.

Prevent deleterious material such as oil from being deposited on the pavement by equipment with devices such as traps, filters, and drip pans.

Before applying HMWM resin system, clean the pavement surface by abrasive blasting and blow loose material from visible cracks with high-pressure air. Remove concrete curing seals from the pavement to be treated. The pavement must be dry when blast cleaning is performed. If the pavement surface becomes contaminated before applying the HMWM resin system, clean the pavement surface by abrasive blasting.

If performing abrasive blasting within 10 feet of a lane occupied by traffic, operate abrasive blasting equipment with a concurrently operating vacuum attachment.

During pavement treatment, protect pavement joints, working cracks, and surfaces not to be treated. Block drains and openings that convey water to water ways.

The machine applying HMWM resin system must combine the components by either static in-line mixers or by external intersecting spray fans. The pump pressure at the spray bars must not cause atomization. Do not use compressed air to produce the spray. Use a shroud to enclose the spray bar apparatus.

You may apply HMWM resin system manually to prevent overspray onto adjacent traffic. If applying resin manually, limit the batch quantity of HMWM resin system to 5 gallons.

Do not apply HMWM resin system in more than 90 percent relative humidity. The prepared area must be dry and the surface temperature must be from 50 to 100 °F when the HMWM resin system is applied. Apply HMWM resin system at a rate of 90 square feet per gallon.

Protect existing facilities from the HMWM resin system application. Repair or replace existing facilities contaminated with HMWM resin system at your expense.

Flood the treatment area with HMWM resin system, penetrating the pavement and cracks. Apply HMWM resin system within 5 minutes after complete mixing. Mixed HMWM resin system viscosity must not increase. Redistribute excess material with squeegees or brooms within 10 minutes of application. Remove excess material from tined grooves.

Wait at least 20 minutes after applying HMWM resin system before applying sand. Apply sand at a rate of approximately 2 pounds per square yard or until refusal. Remove excess sand by vacuuming or sweeping.

Do not allow traffic on the treated surface until:

1. Treated surface is tack-free and non-oily
2. Sand cover adheres enough to resist hand brushing
3. Excess sand is removed
4. Coefficient of friction is at least 0.35 determined under California Test 342

**PAYMENT**

Full compensation for concrete pavement crack treatment is included in the contract price paid per cubic yard for concrete pavement and as designated in the Engineer's Estimate and no separate payment will be made therefor.

**10-1.58 REPAIR SPALLED JOINTS (POLYESTER GROUT)**

This work shall consist of removing unsound or damaged concrete from spalled areas at transverse and longitudinal joints in concrete pavement and filling the area with polyester grout in conformance with these special provisions.

Pavement Types for Repair Spalled Joints
Jointed Plain Concrete Pavement
Rapid Strength Concrete
Precast Prestressed Concrete Pavement

**MATERIALS**

**Polyester Grout**

Polyester grout shall consist of polyester resin binder and dry aggregate. The resin shall be an unsaturated isophthalic polyester-styrene copolymer conforming to the following:

**POLYESTER RESIN BINDER**

Property	Test Method	Requirement
*Viscosity	ASTM Designation: D 2196	0.075 Pa·s to 0.200 Pa·s (RVT, No. 1 Spindle, 20 RPM at 77° F)
*Specific Gravity	ASTM Designation: D 1475	1.05 to 1.10 at 77° F
Elongation	ASTM Designation: D 638	35 percent, minimum Type I at 15/32 inch/min Thickness = 1/4 inch ±1/32 inch
	ASTM Designation: D 618	Sample Conditioning: 18/25/50 + 5/70
Tensile Strength	ASTM Designation: D 638	2,500 psi, minimum Type I at 0.45 inch/min Thickness = 0.25 ±0.05 inch
	ASTM Designation: D 618	Sample Conditioning: 18/25/50 + 5/70
* Styrene Content	ASTM Designation: D 2369	40 percent to 50 percent (by weight)
Silane Coupler		1.0 percent, minimum (by weight of polyester styrene resin)
PCC Saturated Surface Dry Bond Strength	California Test 551	500 psi, minimum at 24 hours and 70° F ±2° F
*Static Volatile Emission	South Coast Air Quality Management District, Standard Method	2 ounces per square yard, loss, maximum

\* Test shall be performed prior to adding initiator.

The silane coupler shall be an organosilane ester, gammamethacryloxypropyltrimethoxysilane. The promoter shall be compatible with suitable methyl ethyl ketone peroxide (MEKP) and cumene hydroperoxide (CHP) initiators.

Aggregate for polyester grout shall conform to the provisions in Section 90-2.02, "Aggregates," of the Standard Specifications and either of the following combined aggregate gradings:

### COMBINED AGGREGATE GRADING

Sieve Size	Percentage Passing	
	3/8" Maximum	No. 4 Maximum
1/2"	100	100
3/8"	83 - 100	100
No. 4	65 - 82	62 - 85
No. 8	45 - 64	45 - 67
No. 16	27 - 48	29 - 50
No. 30	12 - 30	16 - 36
No. 50	6 - 17	5 - 20
No. 100	0 - 7	0 - 7
No. 200	0 - 3	0 - 3

Aggregate retained on the No. 8 sieve shall have a maximum of 45 percent crushed particles when tested in conformance with the requirements in California Test 205. Fine aggregate shall consist of natural sand.

The polyester resin binder in the grout shall be approximately 12 percent by weight of the dry aggregate; the exact percentage will be determined by the Contractor.

The average of coarse and fine aggregate absorption shall not exceed one percent when tested in conformance with the requirements in California Tests 206 and 207.

At the time of mixing with the resin, the moisture content of the combined aggregate, when tested in conformance with the requirements in California Test 226, shall not exceed one half of the average aggregate absorption.

A Material Safety Data Sheet shall be furnished prior to use for each shipment of polyester resin binder.

The Contractor shall allow 14 days for sampling and testing of the polyester resin binder prior to proposed use.

If bulk resin is to be used, the Contractor shall notify the Engineer in writing 10 days prior to the delivery of the bulk resin to the jobsite. Bulk resin is defined as resin that is stored in containers in excess of 55 gallons.

#### **Preformed Compression Seal**

Preformed compression seal shall be placed as shown on the plans and specified in these special provisions. A Certificate of Compliance for compression seal shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate shall be accompanied with a certified test report of the results for the required tests performed on the sealant material within the previous 12 months prior to proposed use. The Certificate and accompanying test report shall be provided for each lot of compression seals in the project.

#### **Joint Insert Installation**

Joint inserts shall be either corrugated cardboard with a 6-mil polyethylene covering or expanded polystyrene material.

#### **Bonding Agent**

Bonding agent shall be as recommended by the polyester grout manufacturer.

### **SPALL REPAIR PROCEDURE**

#### **Concrete Removal**

Outlines of rectangular areas, as marked by the Engineer, shall be cut with a diamond bladed saw to a minimum depth of 1-1/2 inch but not greater than one third the depth of the pavement. Unsound and damaged concrete between the saw cut and the joint, and to the depth of the saw cut, shall be removed by methods that will not damage the concrete pavement that is to remain in place. Damage to the concrete pavement beyond the limits to be removed shall be repaired by the Contractor at his expense. A pneumatic hammer greater than 15 pounds shall not be used for removal of unsound concrete.

Concrete pavement removed to repair spalled joints shall become the property of the Contractor and shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

#### **Cleaning**

After the repair area has been cleared of unsound concrete, the exposed faces of the concrete shall be thoroughly cleaned. Cleaning shall be by abrasive blasting, either sand blasting or high pressure water blasting. Water blasting equipment for concrete cleaning shall be capable of producing a blast pressure of 3,000 pounds per square inch to 6,000 pounds per square inch.

After abrasive blasting, the exposed concrete area shall be cleaned with moisture-free, oil-free compressed air to remove debris. Air compressors shall deliver air at a minimum of 120 cubic feet per minute and develop 90 pounds per square inch of nozzle pressure.

#### **Joint Insert Installation**

Joint inserts shall be placed full depth along the joint and extend one inch beyond the ends of the patch. Joint insert shall be the same width as the existing joint.

#### **Bonding Agent Application**

Bonding agent shall be applied to the surface prior to placing polyester grout. Bonding agents shall be mixed on site in small quantities and in conformance with the requirements of the manufacturer's instructions. Bonding agent shall be applied in a thin even coat by using a stiff bristle brush scrubbing the entire area including the patch walls.

#### **Mixing Polyester Grout**

Fast setting polyester grout shall be mixed in conformance with the requirements in the manufacturer's instructions.

#### **Placement of Grout**

Polyester grout shall be placed on a dry surface. The grout shall air cure with no curing medium applied. The repaired area shall be protected from public traffic for at least one hour after the grout sets.

#### **Resealing Joints**

Existing joints where sealant was removed shall be cleaned, resealed and recessed below the final surface as shown on the plans in conformance with the joint sealant manufacturer's instructions and these special provisions.

### **MEASUREMENT AND PAYMENT**

Repairing spalled joints in existing concrete pavement will be measured by the square yard of the pavement surface area repaired.

Full compensation for all costs involved in installing performed compression seal is included in the unit price paid per linear foot for seal joint (existing concrete pavement) and no additional compensation will be allowed therefor.

The contract price paid per square yard for repair spalled joints (polyester grout) in existing concrete pavement shall include full compensation for furnishing all labor, materials, tools, equipment, including removal and disposal of portions of concrete pavement involved in repairing spalled joints with polyester grout, and incidentals, and for doing all the work involved in repairing spalled joints with polyester grout, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Repair spalled joints (polyester grout) in new concrete pavement is at your expense and will not be measured or paid for.

### **10-1.59 DISPOSAL OF CONCRETE PAVEMENT GRINDING RESIDUES**

Disposal of concrete pavement grinding residues shall be in conformance with the provisions in Section 42, "Groove and Grind Pavement," of the Standard Specifications and these special provisions.

The Contractor shall include water pollution control measures to address the handling of the grinding pavement residue within the Storm Water Pollution Prevention Plan or Water Pollution Control Program, as specified in "Water Pollution Control" of these special provisions.

Temporary storage of concrete pavement grinding residues shall not be allowed within the highway right of way. The Contractor may transport liquid concrete pavement grinding residues to an offsite drying location if the Engineer provides written approval. The offsite drying location shall be identified and protected in conformance with "Water Pollution Control" of these special provisions.

A Materials Information Handout is not available for disposal of concrete pavement grinding residues. The Contractor shall dispose of concrete pavement grinding residues in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside of the Right of Way," of the Standard Specifications. The facilities listed below were permitted by Regional Water Quality Control Board (RWQCB) or other agencies that may accept concrete pavement grinding residues as of July 1, 2004. If the Contractor is planning to use one of these sites, the Contractor shall determine if the facility has a current permit to accept concrete pavement grinding residues and if the facility can accept the waste at the time of generation.

Site Name	Location	Telephone	Waste Types / Restrictions
Clean Harbors Environmental Services Buttonwillow	2500 West Lokern Road Buttonwillow, CA	(562) 432-5445	Hazardous Solids and Non-Hazardous Liquids and Solids
Clean Harbors Environmental Services San Jose	1021 Berryessa San Jose, CA	(408) 451-5000	Hazardous and Non-Hazardous Liquids
Crosby & Overton, Inc.	1610 W. 17th Street Long Beach, CA	(562) 432-5445	Hazardous and Non-Hazardous Liquids
D/K Environmental	3650 East 26th Street Vernon, CA	(323) 268-5056	Hazardous and Non-Hazardous Liquids and Solids
DeMenno-Kerdoon	200 N. Alameda Street Compton, CA	(323) 268-5057 (310) 537-7100	Hazardous and Non-Hazardous Liquids and Solids
Filter Recycling Services, Inc.	180 West Monte Avenue Rialto, CA	(909) 424-1630	Hazardous and Non-Hazardous Liquids
K-Pure Water Works	8910 Rochester Ave Rancho Cucamonga, CA	(909) 476-2308	Non-Hazardous Liquids
Liquid Waste Management McKittrick	56533 Highway 58 McKittrick, CA	(559) 386-6104	Non-Hazardous Liquids and Solids
Onyx Environmental Services LLC	1704 W. First Street Azusa, CA	(626) 334-5117	Hazardous and Non-Hazardous Liquids and Solids
Phibro-Tech, Inc.	8851 Dice Road Santa Fe Springs, CA	(562) 698-8036	Hazardous and Non-Hazardous Liquids and Solids
Romic Environmental Technologies Corporation	2081 Bay Road East Palo Alto, CA	(650) 324-1638	Hazardous and Non-Hazardous Liquids
Seaport Environmental	700 Seaport Boulevard Redwood City, CA	(650) 364-8154	Non-Hazardous Liquids
Southwest Treatment Systems, Inc.	4120 Bandini Boulevard Los Angeles, CA	(800) 900-3366	Non-Hazardous Liquids
US Filter Recovery Services, Inc.	5375 S. Boyle Avenue Vernon, CA	(323) 277-1495	Hazardous and Non-Hazardous Liquids and Solids
Waste Management Kettleman City	35251 Old Skyline Road Kettleman City, CA	(559) 386-6104	Hazardous and Non-Hazardous Liquids and Solids

If the Contractor disposes of concrete pavement grinding residues at locations not listed above, the disposal shall be in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications, and the following:

- A. If the disposal facility is located within the State of California, the facility must be permitted by the RWQCB or other applicable agency, or the Contractor must obtain written approval from the RWQCB or other applicable agency.
- B. If located outside of the State of California, the facility must be permitted by the applicable local, state, or federal agencies, or the Contractor must obtain written approval from the applicable local, state, or federal agencies.

The following shall be delivered to the Engineer at least 5 days before disposal of concrete pavement grinding residues:

- A. The name, address, and telephone number of the disposal facility.
- B. If the facility is not listed above:
  1. Copy of the facility's RWQCB or other applicable agency permit, or
  2. RWQCB's or other applicable agency's approval, or
  3. Copy of the applicable agency permit if the final disposal location is located outside of the State of California.

The Contractor shall deliver landfill receipts and weight ticket of disposal of residues from concrete pavement grinding to the Engineer within 5 days of completing of concrete pavement grinding activities.

The Contractor shall make all arrangements and agreements for the disposal at the time of bidding. Costs related to obtaining approval for disposal within the State of California from the RWQCB or other applicable agency, or the applicable agency if the disposal location is located outside of the State of California, shall be borne by the Contractor and no additional payment shall be made therefore. Full compensation for all costs involved in disposing of concrete pavement grinding residues as specified in this section, including all costs of handling, temporary storage, hauling and disposal fees, shall be considered as included in the price paid for the contract item of work involving concrete pavement grinding residues and no additional compensation will be allowed therefore.

**10-1.60 PILING**

**GENERAL**

Piling shall conform to the provisions in Section 49, "Piling," of the Standard Specifications, and these special provisions.

Unless otherwise specified, welding of any work performed in conformance with the provisions in Section 49, "Piling," of the Standard Specifications, shall be in conformance with the requirements in AWS D1.1.

Attention is directed to "Project Information" and "Welding" of these special provisions.

At locations with driven piles, difficult pile installation is anticipated due to the presence of dense soils, and the requirements of vibration monitoring and traffic control.

Additionally, at Atlantic Boulevard On-Ramp Undercrossing (Bridge Number 53-3067), difficult pile installation is anticipated due to the presence of existing piles.

At locations with cast-in-drilled-hole piles, difficult pile installation is anticipated due to the presence of caving soils, and the requirements of traffic control.

Additionally, at Route 710/5 Separation (East) (Bridge Number 53-0785R), difficult pile installation is anticipated due to ground water above the specified pile tip elevation.

When a calculated nominal driving resistance is shown on the plans for piling, that value shall be utilized in lieu of nominal resistance in Section 49, "Piling," of the Standard Specifications, the plans, and these special provisions.

**Predrilled Holes**

Piles shall be driven in oversized drilled holes in conformance with the provisions in Section 49-1.06, "Predrilled Holes," of the Standard Specifications at the locations and to the corresponding bottom of hole elevations listed in the following table:

Bridge Name or Number	Abutment Number	Bent Number	Elevation of Bottom of Hole
Los Angeles River Bridge (Br. Num. 53-0828)	1	--	86 feet
Los Angeles River Bridge (Br. Num. 53-0828)	5 (including retaining walls)	--	93 feet

In addition to conforming to the provisions in Section 49-1.05, "Driving Equipment," of the Standard Specifications, should obstructions to driving be encountered, the Contractor shall provide special driving tips or heavier pile sections, or shall subexcavate below the bottom of footing, or take other measures to prevent damage to the pile during driving. Full compensation for providing special tips, heavier sections, or for subexcavating or employing other measures to prevent damage to the piles shall be considered as included in the contract price paid per unit for drive steel pile of the size shown on the plans, and no additional compensation will be allowed therefor.

**Redriving**

Piles at Los Angeles River Bridge (Bridge Number 53-0828), Atlantic Boulevard On-Ramp Undercrossing (Bridge Number 53-3067), and Atlantic Boulevard Undercrossing (Bridge Number 53-1009) that do not attain the required bearing value when the pile tip has reached the specified tip elevation shall be allowed to stand for a "set period" without driving. The "set period" shall be at least 24 hours unless bearing has been obtained sooner. After the required "set period" has elapsed, 2 piles or 10 percent of such piles in a footing, whichever is greater, shall be redriven. The Engineer will designate which piles are to be redriven. Redriving shall consist of operating the driving hammer at full rated energy on the pile and then measuring the bearing value of the pile.

If the required bearing value has been attained for each pile designated to be redriven, then the remaining piles in that footing shall be considered satisfactory and further driving will not be required. If redriving said designated piles demonstrates that the required bearing value has not been attained, all piles in that footing shall be redriven until the required bearing value has been reached.

Full compensation for redriving and for conforming to the requirements for "set period" and any delays in connection therewith shall be considered as included in the contract unit price paid for driving the piles involved and no separate payment will be made therefor.

## **CAST-IN-DRILLED-HOLE CONCRETE PILES**

### **GENERAL**

#### **Summary**

Cast-in-drilled-hole (CIDH) concrete piling shall conform to the provisions in Section 49-4, "Cast-In-Place Concrete Piles," of the Standard Specifications and these special provisions.

The provisions of "Welding" of these special provisions shall not apply to temporary steel casings.

### **SUBMITTALS**

#### **Pile Installation Plan**

The Contractor shall submit a pile installation plan to the Engineer for approval for all CIDH concrete piling. The pile installation plan shall be submitted at least 15 days before constructing CIDH concrete piling and shall include complete descriptions, details, and supporting calculations for the following:

- A. Concrete mix design, certified test data, and trial batch reports.
- B. Drilling or coring methods and equipment.
- C. Proposed method for casing installation and removal when necessary.
- D. Plan view drawing of pile showing reinforcement. Include inspection pipes on the drawing if inspection pipes are required.
- E. Methods for placing, positioning, and supporting bar reinforcement.
- F. Methods and equipment for determining the depth of concrete and actual and theoretical volume placed, including effects on volume of concrete when any casings are withdrawn.
- G. Methods and equipment for verifying that the bottom of the drilled hole is clean before placing concrete.
- H. Methods and equipment for preventing upward movement of reinforcement, including the Contractor's means of detecting and measuring upward movement during concrete placement operations.

For concrete placed under slurry, the pile installation plan shall also include complete descriptions, details, and supporting calculations for the following:

- A. Concrete batching, delivery, and placing systems, including time schedules and capacities. Time schedules shall include the time required for each concrete placing operation at each pile.
- B. Concrete placing rate calculations. When requested by the Engineer, calculations shall be based on the initial pump pressures or static head on the concrete and losses throughout the placing system, including anticipated head of slurry and concrete to be displaced.
- C. Suppliers' test reports on the physical and chemical properties of the slurry and any proposed slurry chemical additives, including Material Safety Data Sheet.
- D. Slurry testing equipment and procedures.
- E. Methods of removal and disposal of excavation, slurry, and contaminated concrete, including removal rates.
- F. Methods and equipment for slurry agitating, recirculating, and cleaning.

### **QUALITY ASSURANCE**

#### **Concrete Test Batch**

Before concrete is deposited under slurry, a concrete test batch shall be produced and delivered to the project under conditions and in time periods similar to those expected during placement of concrete in the piles. Concrete shall be placed in an excavated hole or suitable container of adequate size to allow for testing as specified herein. Depositing of concrete under slurry will not be required. In addition to meeting the specified nominal slump, the concrete test batch shall meet the following requirements:

- A. For piles where the time required for each concrete placing operation, as submitted in the placing plan, will be 2 hours or less, the concrete test batch shall demonstrate that the proposed concrete mix design achieves a slump of at least 7 inches after twice that time has elapsed.
- B. For piles where the time required for each concrete placing operation, as submitted in the placing plan, will be more than 2 hours, the concrete test batch shall demonstrate that the proposed concrete mix design achieves a slump of at least 7 inches after that time plus 2 hours has elapsed.

The time period shall begin at the start of placement. Concrete shall not be vibrated or agitated during the test period. Slump tests will be performed in conformance with the requirements in California Test 556.

Upon completion of testing, concrete shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

## **MATERIALS**

### **Concrete**

Concrete deposited under slurry shall have a nominal slump equal to or greater than 7 inches, contain not less than 675 pounds of cementitious material per cubic yard, and be proportioned to prevent excessive bleed water and segregation. The nominal and maximum slump and penetration requirements in Section 90-6.06, "Amount of Water and Penetration," of the Standard Specifications shall not apply.

Concrete shall conform to the requirements in "Corrosion Control for Portland Cement Concrete" of these special provisions.

### **Aggregate Grading**

The combined aggregate grading shall be either the 1-inch maximum grading, the 1/2-inch maximum grading, or the 3/8-inch maximum grading and shall conform to the requirements in Section 90-3, "Aggregate Gradings," of the Standard Specifications.

When concrete is placed under slurry, the combined aggregate grading shall be either the 1/2-inch maximum grading or the 3/8-inch maximum grading and shall conform to the requirements in Section 90-3, "Aggregate Gradings," of the Standard Specifications.

### **Slurry**

#### **Mineral Slurry**

Mineral slurry shall be mixed and thoroughly hydrated in slurry tanks, and slurry shall be sampled from the slurry tanks and tested before placement in the drilled hole.

Slurry shall be recirculated or continuously agitated in the drilled hole to maintain the specified properties.

Recirculation shall include removal of drill cuttings from the slurry before discharging the slurry back into the drilled hole. When recirculation is used, the slurry shall be sampled and tested at least every 2 hours after beginning its use until tests show that the samples taken from the slurry tank and from near the bottom of the hole have consistent specified properties. Subsequently, slurry shall be sampled at least twice per shift as long as the specified properties remain consistent.

Slurry that is not recirculated in the drilled hole shall be sampled and tested at least every 2 hours after beginning its use. The slurry shall be sampled mid-height and near the bottom of the hole. Slurry shall be recirculated when tests show that the samples taken from mid-height and near the bottom of the hole do not have consistent specified properties.

Slurry shall also be sampled and tested before final cleaning of the bottom of the hole and again just before placing concrete. Samples shall be taken from mid-height and near the bottom of the hole. Cleaning of the bottom of the hole and placement of the concrete shall not start until tests show that the samples taken from mid-height and near the bottom of the hole have consistent specified properties.

Mineral slurry shall be tested for conformance to the requirements shown in the following table:

MINERAL SLURRY		
PROPERTY	REQUIREMENT	TEST
Density (pcf ) - before placement in the drilled hole - during drilling  - before final cleaning - immediately before placing concrete	64.3* to 69.1*  64.3* to 75.0*	Mud Weight (Density) API 13B-1 Section 1
Viscosity (seconds/quart)  bentonite  attapulgate	28 to 50  28 to 40	Marsh Funnel and Cup API 13B-1 Section 2.2
pH	8 to 10.5	Glass Electrode pH Meter or pH Paper
Sand Content (percent)  - before final cleaning - immediately before placing concrete	less than or equal to 4.0	Sand API 13B-1 Section 5
*When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 2 pcf. Slurry temperature shall be at least 40°F when tested.		

Any caked slurry on the sides or bottom of hole shall be removed before placing reinforcement. If concrete is not placed immediately after placing reinforcement, the reinforcement shall be removed and cleaned of slurry, the sides of the drilled hole cleaned of caked slurry, and the reinforcement again placed in the hole for concrete placement.

### Synthetic Slurry

Synthetic slurries shall be used in conformance with the manufacturer's recommendations and these special provisions. The following synthetic slurries may be used:

PRODUCT	MANUFACTURER
SlurryPro CDP	KB Technologies Ltd. 3648 FM 1960 West Suite 107 Houston, TX 77068 (800) 525-5237
Super Mud	PDS Company c/o Champion Equipment Company 8140 East Rosecrans Ave. Paramount, CA 90723 (562) 634-8180
Shore Pac GCV	CETCO Drilling Products Group 1350 West Shure Drive Arlington Heights, IL 60004 (847) 392-5800
Novagel Polymer	Geo-Tech Drilling Fluids 220 N. Zapata Hwy, Suite 11A Laredo, TX 78043 (210) 587-4758

Inclusion of a synthetic slurry on the above list may be obtained by meeting the Department's requirements for synthetic slurries. The requirements can be obtained from the Offices of Structures Design, P.O. Box 168041, MS# 9-4/11G, Sacramento, CA 95816-8041.

Synthetic slurries listed may not be appropriate for a given site.

Synthetic slurries shall not be used in holes drilled in primarily soft or very soft cohesive soils as determined by the Engineer.

A manufacturer's representative, as approved by the Engineer, shall provide technical assistance for the use of their product, shall be at the site before introduction of the synthetic slurry into a drilled hole, and shall remain at the site until released by the Engineer.

Synthetic slurries shall be sampled and tested at both mid-height and near the bottom of the drilled hole. Samples shall be taken and tested during drilling as necessary to verify the control of the properties of the slurry. Samples shall be taken and tested when drilling is complete, but before final cleaning of the bottom of the hole. When samples are in conformance with the requirements shown in the following tables for each slurry product, the bottom of the hole shall be cleaned and any loose or settled material removed. Samples shall be obtained and tested after final cleaning and immediately before placing concrete.

SlurryPro CDP synthetic slurries shall be tested for conformance to the requirements shown in the following table:

SLURRYPRO CDP KB Technologies Ltd.		
PROPERTY	REQUIREMENT	TEST
Density (pcf ) - during drilling  - before final cleaning - just before placing concrete	less than or equal to 67.0*  less than or equal to 64.0*	Mud Weight (Density) API 13B-1 Section 1
Viscosity (seconds/quart) - during drilling  -before final cleaning - just before placing concrete	50 to 120  less than or equal to 70	Marsh Funnel and Cup API 13B-1 Section 2.2
pH	6 to 11.5	Glass Electrode pH Meter or pH Paper
Sand Content (percent) - before final cleaning - just before placing concrete	less than or equal to 0.5	Sand API 13B-1 Section 5
*When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 2 pcf. Slurry temperature shall be at least 40°F when tested.		

Super Mud synthetic slurries shall be tested for conformance to the requirements shown in the following table:

SUPER MUD PDS Company		
PROPERTY	REQUIREMENT	TEST
Density (pcf) - before final cleaning - just before placing concrete	less than or equal to 64.0*	Mud Weight (Density) API 13B-1 Section 1
Viscosity (seconds/quart) - during drilling  - before final cleaning - just before placing concrete	32 to 60  less than or equal to 60	Marsh Funnel and Cup API 13B-1 Section 2.2
pH	8 to 10.0	Glass Electrode pH Meter or pH Paper
Sand Content (percent) - before final cleaning -just before placing concrete	less than or equal to 0.5	Sand API 13B-1 Section 5
*When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 2 pcf. Slurry temperature shall be at least 40°F when tested.		

Shore Pac GCV synthetic slurries shall be tested for conformance to the requirements shown in the following table:

Shore Pac GCV CETCO Drilling Products Group		
PROPERTY	REQUIREMENT	TEST
Density (pcf) - before final cleaning - just before placing concrete	less than or equal to 64.0*	Mud Weight (Density) API 13B-1 Section 1
Viscosity (seconds/quart) - during drilling  - before final cleaning - just before placing concrete	33 to 74  less than or equal to 57	Marsh Funnel and Cup API 13B-1 Section 2.2
pH	8.0 to 11.0	Glass Electrode pH Meter or pH Paper
Sand Content (percent) - before final cleaning -just before placing concrete	less than or equal to 0.5	Sand API 13B-1 Section 5
*When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 2 pcf. Slurry temperature shall be at least 40°F when tested.		

Novagel Polymer synthetic slurries shall be tested for conformance to the requirements shown in the following table:

NOVAGEL POLYMER Geo-Tech Drilling Fluids		
PROPERTY	REQUIREMENT	TEST
Density (pcf) - during drilling  - before final cleaning - just before placing concrete	less than or equal to 67.0*  less than or equal to 64.0*	Mud Weight (Density) API 13B-1 Section 1
Viscosity (seconds/quart) - during drilling  - before final cleaning - just before placing concrete	45 to 104  less than or equal to 104	Marsh Funnel and Cup API 13B-1 Section 2.2
pH	6.0 to 11.5	Glass Electrode pH Meter or pH Paper
Sand Content (percent) - before final cleaning - just before placing concrete	less than or equal to 0.5	Sand API 13B-1 Section 5
*When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 2 pcf. Slurry temperature shall be at least 40°F when tested.		

## Water Slurry

At the option of the Contractor, water may be used as slurry when casing is used for the entire length of the drilled hole. Water slurry shall be tested for conformance to the requirements shown in the following table:

WATER SLURRY		
PROPERTY	REQUIREMENT	TEST
Density (pcf)  - before final cleaning - just before placing concrete	63.5*	Mud Weight (Density) API 13B-1 Section 1
Sand Content (percent)  - before final cleaning - just before placing concrete	less than or equal to 0.5	Sand API 13B-1 Section 5
*When approved by the Engineer, salt water slurry may be used and the allowable densities may be increased up to 2 pcf.		

## CONSTRUCTION

### General

CIDH concrete piling 24 inches in diameter or larger may be constructed by excavation and depositing concrete under slurry.

Portions of CIDH concrete piling shown on the plans to be formed shall be formed and finished in conformance with the provisions for concrete structures in Section 51, "Concrete Structures," of the Standard Specifications.

Reinforcement shall extend to 3 inches clear of the bottom of the drilled hole when the hole is drilled below the specified tip elevation.

### Placing Concrete

Concrete deposited under slurry shall be carefully placed in a compact, monolithic mass and by a method that will prevent washing of the concrete. Concrete deposited under slurry need not be vibrated. Placing concrete shall be a continuous operation lasting not more than the time required for each concrete placing operation at each pile, as submitted in the placing plan, unless otherwise approved in writing by the Engineer. Concrete shall be placed with concrete pumps and delivery tube system of adequate number and size to complete the placing of concrete in the time specified. The delivery tube system shall consist of one of the following:

- A. A tremie tube or tubes, each of which are at least 10 inches in diameter, fed by one or more concrete pumps.
- B. One or more concrete pump tubes, each fed by a single concrete pump.

The delivery tube system shall consist of watertight tubes with sufficient rigidity to keep the ends always in the mass of concrete placed. If only one delivery tube is utilized to place the concrete, the tube shall be placed near the center of the drilled hole. Multiple tubes shall be uniformly spaced in the hole. Internal bracing for the steel reinforcing cage shall accommodate the delivery tube system. Tremies shall not be used for piles without space for a 10-inch tube.

Spillage of concrete into the slurry during concrete placing operations shall not be allowed. Delivery tubes shall be capped with a watertight cap, or plugged above the slurry level with a good quality, tight fitting, moving plug that will expel the slurry from the tube as the tube is charged with concrete. The cap or plug shall be designed to be released as the tube is charged. The pump discharge or tremie tube shall extend to the bottom of the hole before charging the tube with concrete. After charging the delivery tube system with concrete, the flow of concrete through a tube shall be induced by slightly raising the discharge end. During concrete placement, the tip of the delivery tube shall be maintained as follows to prevent reentry of the slurry into the tube. Until at least 10 feet of concrete has been placed, the tip of the delivery tube shall be within 6 inches of the bottom of the drilled hole, and then the embedment of the tip shall be maintained at least 10 feet below the top surface of the concrete. Rapid raising or lowering of the delivery tube shall not be permitted. If the seal is lost or the delivery tube becomes plugged and must be removed, the tube shall be withdrawn, the tube cleaned, the tip of the tube

capped to prevent entrance of the slurry, and the operation restarted by pushing the capped tube 10 feet into the concrete and then reinitiating the flow of concrete.

When slurry is used, a fully operational standby concrete pump, adequate to complete the work in the time specified, shall be provided at the site during concrete placement. The slurry level shall be maintained 10 feet above the piezometric head or within 12 inches of the top of the drilled hole, whichever is higher.

A log of concrete placement for each drilled hole shall be maintained by the Contractor when concrete is deposited under slurry. The log shall show the pile location, tip elevation, dates of excavation and concrete placement, total quantity of concrete deposited, length and tip elevation of any casing, and details of any hole stabilization method and materials used. The log shall include a 8-1/2" x 11" sized graph of the concrete placed versus depth of hole filled. The graph shall be plotted continuously throughout placing of concrete. The depth of drilled hole filled shall be plotted vertically with the pile tip oriented at the bottom and the quantity of concrete shall be plotted horizontally. Readings shall be made at least at each 5 feet of pile depth, and the time of the reading shall be indicated. The graph shall be labeled with the pile location, tip elevation, cutoff elevation, and the dates of excavation and concrete placement. The log shall be delivered to the Engineer within 1 working day of completion of placing concrete in the pile.

After placing reinforcement and before placing concrete in the drilled hole, if drill cuttings settle out of the slurry, the bottom of the drilled hole shall be cleaned. The Contractor shall verify that the bottom of the drilled hole is clean.

If a temporary casing is used, concrete placed under slurry shall be maintained at a level at least 5 feet above the bottom of the casing. The withdrawal of the casing shall not cause contamination of the concrete with slurry. If slurry is not used, the temporary casing shall not be withdrawn until the concrete head in the casing is greater than the groundwater outside of the casing. This positive concrete head shall be maintained during the withdrawal of the casing.

Material resulting from using slurry shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

### **Acceptance Testing and Mitigation**

Vertical inspection pipes for acceptance testing shall be provided in all CIDH concrete piling 24 inches in diameter or larger, except when the holes are dry or when the holes are dewatered without the use of temporary casing in a manner that controls ground water.

The furnishing and placing of inspection pipes shall conform to the following:

- A. Inspection pipes shall be Schedule 40 PVC pipe with a nominal inside diameter of 2 inches. Watertight PVC couplers are permitted to facilitate pipe lengths in excess of those which are commercially available. The Contractor shall log the location of the inspection pipe couplers with respect to the plane of pile cut off, and these logs shall be delivered to the Engineer upon completion of the placement of concrete in the drilled hole.
- B. Each inspection pipe shall be capped at the bottom and shall extend from 3 feet above the pile cutoff down to the bottom of the reinforcing cage. A temporary top cap or similar means shall be provided to keep the pipes clean before testing. If pile cutoff is below the ground surface or working platform, inspection pipes shall be extended to 3 feet above the ground surface or working platform. Approved covers or railings shall be provided and inspection pipes shall be located as necessary to minimize exposure of testing personnel to potential falling hazards.
- C. Inspection pipes shall be completely clean, dry, and unobstructed at the time of testing providing a 2-inch diameter clear opening.
- D. The inspection pipes shall be installed in straight alignment, parallel to the main reinforcement, and securely fastened in place to prevent misalignment during installation of the reinforcement and placing of concrete in the hole. The CIDH concrete piling shall be constructed so that the relative distance of inspection pipes to vertical steel reinforcement shall remain constant.
- E. When any changes are made to the tip of CIDH concrete piling, the Contractor shall also extend the inspection pipes to the bottom of the reinforcing cage.

The following additional requirements apply if inspection pipes are not shown on the plans:

- A. Inspection pipes shall be placed radially around the pile, inside the outermost spiral or hoop reinforcement and no more than 1 inch clear of the outermost spiral or hoop reinforcement.
- B. Inspection pipes shall be placed around the pile at a uniform spacing not exceeding 33 inches measured along the circle passing through the centers of inspection pipes. A minimum of 2 inspection pipes per pile shall be used. Inspection pipes shall be placed to provide the maximum diameter circle that passes through the centers of the inspection pipes while maintaining the spacing required herein.
- C. Inspection pipes shall be placed a minimum of 3 inches clear of the vertical reinforcement. When the vertical reinforcement configuration does not permit this clearance while achieving radial location requirements, distance to vertical rebar shall be maximized while still maintaining the requirement for radial location.

- D. Where the dimensions of the pile reinforcement do not permit inspection pipes to be placed per these requirements, a plan for tube placement shall be submitted to the Engineer for approval in the Pile Placement Plan with a request for deviation before fabricating pile reinforcement.

After placing concrete and before requesting acceptance tests, each inspection pipe shall be tested by the Contractor in the presence of the Engineer by passing a 1-1/4-inch-diameter rigid cylinder 4.5 feet long through the length of pipe. If an inspection pipe fails to pass the 1-1/4-inch-diameter cylinder, the Contractor shall immediately fill all inspection pipes in the pile with water.

For each inspection pipe that does not pass the 1-1/4-inch-diameter cylinder, the Contractor shall core a nominal 2-inch diameter hole through the concrete for the entire length of the pile. Cored holes shall be located as close as possible to the inspection pipes they are replacing and shall be no more than 5 inches clear from the reinforcement.

Coring shall not damage the pile reinforcement. Cored holes shall be made with a double wall core barrel system utilizing a split tube type inner barrel. Coring with a solid type inner barrel will not be allowed. Coring methods and equipment shall provide intact cores for the entire length of the pile. The coring operation shall be logged by an Engineering Geologist or Civil Engineer licensed in the State of California and experienced in core logging. Coring logs shall be in conformance with the Department's "Soil and Rock Logging, Classification, and Presentation Manual." Coring logs shall include Core Recovery (REC), Rock Quality Designation (RQD), locations of breaks, and complete descriptions of inclusions and voids encountered during coring, and shall be delivered to the Engineer upon completion. Concrete cores shall be preserved, identified with the exact location the core was recovered from within the pile, and delivered to the Engineer upon completion. The Engineer will evaluate the portion of the pile represented by the cored hole based on the submitted core logs.

Acceptance tests of the concrete will be made by the Engineer, without cost to the Contractor. Acceptance tests will evaluate the homogeneity of the placed concrete. Tests will include gamma-gamma logging conducted in conformance with California Test 233. The Contractor shall not conduct operations within 25 feet of the gamma-gamma logging operations. The Contractor shall separate reinforcing steel as necessary to allow the Engineer access to the inspection pipes to perform gamma-gamma logging or other acceptance testing. After requesting acceptance tests and providing access to the piles, the Contractor shall allow 20 days for the Engineer to conduct these tests and make determination of acceptance. Should the Engineer fail to complete these tests within the time allowance, and if in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in inspection, the delay will be considered a right of way delay as specified in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The Engineer may elect to perform additional tests to further evaluate a pile. These tests may include crosshole sonic logging and other means of inspection selected by the Engineer. When the Engineer elects to perform additional tests to further evaluate anomalies for a rejected pile, no time requirement exists for performing these tests. The Contractor may progress with the mitigation plan process without waiting for these supplemental results.

Inspection pipes and cored holes shall be dewatered and filled with grout after notification by the Engineer that the pile is acceptable. Grout shall conform to the provisions in Section 50-1.09, "Bonding and Grouting," of the Standard Specifications. Inspection pipes and holes shall be filled using grout tubes that extend to the bottom of the pipe or hole or into the grout already placed.

If acceptance testing performed by the Engineer determines that a pile does not meet the requirements of the specifications and California Test 233, Part 5C, then that pile will be rejected and all depositing of concrete under slurry or concrete placed using temporary casing for the purpose of controlling groundwater shall be suspended until written changes to the methods of pile construction are approved in writing by the Engineer.

The Engineer will determine whether the rejected pile requires mitigation due to structural, geotechnical, or corrosion concerns. The Engineer will consider the estimated size and location of the anomaly and potential effects upon the design. The Engineer will provide the conclusions of this analysis to the Contractor for development of a mitigation plan, if required. The Contractor shall allow 35 days for the Engineer to determine whether the pile requires mitigation and provide information to the Contractor. Day 1 of the 35 days shall be the 1st day after access has been provided to the Engineer to perform acceptance testing. If additional information is submitted to the Engineer that modifies the size, shape, or nature of the anomaly, the Contractor shall allow 15 additional days for the subsequent analysis.

If the Engineer determines that a rejected pile does not require mitigation, the Contractor may elect to (1) repair the pile per the approved mitigation plan or (2) not repair anomalies found during acceptance testing of that pile. For such unrepaired piles, the Contractor shall pay to the State, \$300 per cubic yard for the portion of the pile affected by the anomalies. The volume, in cubic yards, of the portion of the pile affected by the anomalies, shall be calculated as the area of the cross section of the pile affected by each anomaly, in square yards, as determined by the Engineer, multiplied by the distance, in yards, from the top of each anomaly to the specified tip of the pile. If the volume calculated for one anomaly overlaps the volume calculated for additional anomalies within the pile, the calculated volume for the overlap shall only be counted once. In no case shall the amount of the payment to the State for any such pile be less than \$300. The Department may deduct the amount from any moneys due, or that may become due the Contractor under the contract.

If the Engineer determines that a rejected pile requires mitigation, the Contractor shall submit to the Engineer for approval a mitigation plan for repair, supplementation, or replacement for each rejected CIDH concrete pile conforming to the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. If the Engineer determines that it is not feasible to repair the rejected pile, the Contractor shall not include repair as a means of mitigation and shall proceed with the submittal of a mitigation plan for replacement or supplementation of the rejected pile.

Pile mitigation plans shall include the following:

- A. The designation and location of the pile addressed by the mitigation plan.
- B. A review of the structural, geotechnical, and corrosion design requirements of the rejected pile.
- C. A step by step description of the mitigation work to be performed, including drawings if necessary.
- D. An assessment of how the proposed mitigation work will address the structural, geotechnical, and corrosion design requirements of the rejected pile.
- E. Methods for preservation or restoration of existing earthen materials.
- F. A list of affected facilities, if any, with methods and equipment for protection of these facilities during mitigation.
- G. The State assigned contract number, bridge number, full name of the structure as shown on the contract plans, District-County-Route-Post Mile, and the Contractor's (and Subcontractor's if applicable) name on each sheet.
- H. A list of materials, with quantity estimates, and personnel, with qualifications, to be used to perform the mitigation work.
- I. The seal and signature of an engineer who is licensed as a Civil Engineer by the State of California. This requirement is waived for approved mitigation plans when either of the following conditions are present:
  1. The proposed mitigation will be performed in conformance with the most recent Department approved version of "ADSC Standard Mitigation Plan 'A' - Basic Repair" without exception or modification.
  2. The Engineer has determined that the rejected pile does not require mitigation due to structural, geotechnical, or corrosion concerns, and the Contractor elects to repair the pile using most recent Department approved version of "ADSC Standard Mitigation Plan 'B' - Grouting Repair" without exception or modification.

The most recent Department approved version of the "ADSC Standard Mitigation Plan" is available at:

<http://www.dot.ca.gov/hq/esc/geotech/ft/adscmitplan.htm>

For rejected piles to be repaired, the Contractor shall submit a pile mitigation plan that contains the following additional information:

- A. An assessment of the nature and size of the anomalies in the rejected pile.
- B. Provisions for access for additional pile testing if required by the Engineer.

For rejected piles to be replaced or supplemented, the Contractor shall submit a pile mitigation plan that contains the following additional information:

- A. The proposed location and size of additional piles.
- B. Structural details and calculations for any modification to the structure to accommodate the replacement or supplemental piles.

All provisions for CIDH concrete piling shall apply to replacement piles.

The Contractor shall allow the Engineer 20 days to review the mitigation plan after a complete submittal has been received.

Should the Engineer fail to review the complete pile mitigation submittal within the time specified, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the pile mitigation plan, an extension of time commensurate with the delay in completion of the work thus caused will be granted in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

When repairs are performed, the Contractor shall submit a mitigation report to the Engineer within 10 days of completion of the repair. This report shall state exactly what repair work was performed and quantify the success of the repairs relative to the submitted mitigation plan. The mitigation report shall be stamped and signed by an engineer that is licensed as a Civil Engineer by the State of California. The mitigation report shall show the State assigned contract number, bridge number, full name of the structure as shown on the contract plans, District-County-Route-Post Mile, and the Contractor (and subcontractor if applicable) name on each sheet. The Engineer will be the sole judge as to whether a mitigation proposal is acceptable, the mitigation efforts are successful, and to whether additional repairs, removal and replacement, or construction of a supplemental foundation is required.

## **STEEL PIPE PILING**

### **GENERAL**

#### **Summary**

Steel pipe piling shall consist of unfilled steel pipe piling. Steel pipe piling shall conform to the provisions in Section 49-5, "Steel Piles," of the Standard Specifications and these special provisions.

All steel pipe piling for this project shall be designated as Class R steel pipe piling.

#### **Submittals**

Steel pipe piling qualification audits shall be submitted in conformance with the provisions in "Steel Pipe Piling Qualification Audit" of these special provisions.

A Certificate of Compliance demonstrating material traceability shall be furnished in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications, and shall be signed by the facility's authorized Quality Control Representative. The Quality Control Representative shall be on record with the Department's Office of Structural Materials. The Certificate of Compliance shall include:

1. A statement that all materials and workmanship incorporated in the work and all required tests and inspections of this work have been performed in conformance with the details shown on the plans and these special provisions.
2. An attached certified mill test report (MTR) for each heat number of steel pipe piles being furnished.
3. The carbon equivalency (CE) calculated as  $CE=C + (Mn+Si)/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15$ . The CE shall be 0.45% maximum and may be shown on the MTR.

The Contractor shall submit a TL-38 Inspection Request form at least:

1. 48 hours before performing any field welding of steel pipe piling.

The TL-38 Inspection Request form is available at:

<http://www.dot.ca.gov/hq/esc/Translab/OSM/smbforms.htm>

Working drawings shall be submitted to the Engineer before attaching handling devices to steel pipe piling. Working drawings shall include locations, handling and fitting device details, and connection details. Attachments shall not be made to steel pipe piling until the working drawings are approved in writing by the Engineer. The Contractor shall allow the Engineer 7 days for review.

### **MATERIALS**

#### **General**

The provisions of "Welding Quality Control" of these special provisions shall not apply to longitudinal, skelp end, or spiral seam welds in steel pipe piling.

Circumferential welds shall conform to "Welding Quality Control" of these special provisions and the following:

1. Circumferential welds shall be complete joint penetration welds conforming to AWS D1.1.
2. Welds shall be located at least 12 inches away from a skelp end weld.
3. Backing rings shall conform to the following:
  - 3.1. The minimum thickness shall be 1/4 inch and the backing ring shall be continuous.
  - 3.2. Splices in the backing ring shall be made by complete joint penetration welds. These welds shall be completed and inspected, including any required nondestructive testing, before final insertion into a pipe end.
  - 3.3. The attachment of backing rings to pipe ends shall be done using the minimum size and spacing of tack welds that will securely hold the backing ring in place. Tack welding shall be done in the root area of the weld splice. Cracked tack welds shall be removed and replaced before subsequent weld passes.
  - 3.4. The gap between the backing ring and the steel pipe piling wall shall not be greater than 5/64 inch. One localized portion of the backing ring fit-up, that is equal to or less than a length that is 20 percent of the outside circumference of the pipe, as determined by the Engineer, may be offset by a gap equal to or less than 1/4 inch, provided that this localized portion is first seal welded using shielded metal arc E7016 or E7018 electrodes. This localized portion shall be marked so that it can be referenced during any required NDT.
  - 3.5. Backing rings shall have sufficient width so that the backing ring will not interfere with the interpretation of the NDT.

4. For steel pipe with an outside diameter greater than 42 inches and with a wall thickness greater than 1 inch, the root opening tolerances may be increased to a maximum of 3/16 inch.
5. For welding limited to fit-up and attaching backing rings and handling devices, the preheat and interpass temperature shall be in conformance with the requirements in AWS D1.1, Clause 3.5, "Minimum Preheat and Interpass Temperature Requirements," and with Table 3.2, Category C.

All steel pipe piling shall be capable of meeting the fit-up requirements of AWS D1.1, Clause 5.22.3.1, "Girth Weld Alignment (Tubular)," when the material is spliced utilizing a girth weld.

For the purposes of welding and prequalification of base metal, steel pipe piling designated as ASTM A 252 shall be treated as ASTM A 572, Grade 50, or ASTM A 709, Grade 50, in conformance with the requirements in AWS D1.1, Table 3.1.

Butt welded seams subsequently formed, including skelp end welds, shall be 100 percent ultrasonically tested in the final formed and welded condition. The acceptance criteria for UT shall conform to API 5L for API-licensed facilities or AWS D1.1 for cyclically loaded nontubular connections for welds subject to tensile stress.

Except for tack welding, gas metal arc welding (GMAW) shall not be used for the welding of steel pipe piling. When GMAW is used for tack welding, the filler metal shall not be deposited by short circuiting transfer.

The dimensional tolerances of steel pipe piling shall conform to the following:

1. Outside diameter:  $\pm 0.75\%$  of the specified outside diameter
2. Wall thickness:  $-5\%$ ,  $+10\%$  of the specified nominal wall thickness
3. Straightness:  $\pm 1.0\%$  over the length of the pipe

Except for steel pipe piling marked with the API monogram, each length of steel pipe piling shall be marked as follows:

1. Name and location of the piling manufacturer
2. State Contract number
3. Heat number
4. Welding process
5. Outer diameter, nominal wall thickness, minimum wall thickness, and length
6. Year piling was produced
7. Marked as specified below for each class of steel pipe piling. Only Caltrans audited facilities are approved to mark piling for use on this project.

### **Class R Steel Pipe Piling**

Class R steel pipe piling shall conform to one of the following:

1. Manufactured, welded, tested, and inspected in conformance with API 5L, minimum Grade X52, PSL1, and the following:
  - 1.1. Steel pipe piling shall be manufactured by a facility licensed to apply the API monogram.
  - 1.2. Hydrostatic testing, flattening tests, and the API monogram will not be required.
  - 1.3. Each length shall be marked "Caltrans Class R - API."
2. Manufactured in conformance with ASTM A 252, Grade 3, and the following:
  - 2.1. Arc welding processes shall conform to AWS D1.1.
  - 2.2. Groove welds using submerged arc welding from both sides without backgouging will require a procedure qualification record witnessed by the Engineer.
  - 2.3. Underfill will not be allowed.
  - 2.4. For electric resistance welded pipe, the outer diameter flash shall be removed to a maximum of 1/32 inch.
  - 2.5. The weld reinforcement shall not exceed 1/8 inch.
  - 2.6. The weighing of individual pipe will not be required as specified in ASTM A 252.
  - 2.7. Each length shall be marked "Caltrans Class R - A 252."

## **CONSTRUCTION**

### **General**

Steel pipe piling may be re-tapped to prevent pile set-up provided the field welded splice remains at least 3 feet above the work platform until that splice is approved in writing by the Engineer.

Welds used to attach handling devices to steel pipe piling shall be aligned parallel to the axis of the pile and shall conform to the requirements for field welding specified herein. Permanent bolted connections shall be corrosion resistant.

### **Field Welding**

Field welding of steel pipe piling is defined as welding performed after the material has been transported from an audited facility.

Field welding shall conform to the requirements for circumferential welds as specified in "Materials" of this section and the following:

1. Welds made in the horizontal position where the longitudinal pipe axis is vertical shall be single-bevel groove welds.
2. The minimum preheat and interpass temperature for splice welding and for making repairs shall be 150 °F, regardless of the pipe pile wall thickness or steel grade. In the event welding is disrupted, preheating to 150 °F shall occur before welding is resumed.
3. Welds shall not be water quenched. Welds shall be allowed to cool unassisted to ambient temperature.

### **STEEL SOLDIER PILING**

This work at Retaining Wall 1271 shall consist of furnishing and installing steel piling; securing the piling prior to and during concrete encasement; shaping the tops of the piles; cleaning and preparing portions of the pile for welding concrete anchors; and furnishing, cleaning and welding concrete anchors to piling in accordance with the details shown on the plans, and these special provisions.

### **Materials**

Concrete anchors shall conform to the provisions for stud connectors in Section 55, "Steel Structures," of the Standard Specifications and these special provisions.

Stud connectors shall be Type B as defined in AWS D1.5, Clause 7.

### **Construction**

Steel soldier piles shall be placed in a drilled hole and shall be plumbed and aligned before placing concrete backfill and lean concrete backfill. Alignment shall be maintained while placing backfill material in the drilled holes.

Cleaning and preparing the pile shall be performed in heat affected areas before splicing steel piles or welding stud type shear connectors.

### **MICROPILING**

Micropiling consisting of NPS 12-XX Strong steel pipe that is grouted in place shall conform to the details shown on the plans and these special provisions.

### **Materials**

Double extra strong steel pipe shall conform to the requirements of ASTM Designation: A 501, Grade A.

Grout shall conform to the provisions in Section 50-1.09, "Bonding and Grouting," of the Standard Specifications. California Test 541 will not be required, nor will the grout be required to pass through a screen with a No. 16 sieve before being introduced into the grout pump. Grout shall be non-shrink type. Grout in micropiles shall be installed under at least 145 psi pressure. Grout shall develop compressive strengths of at least 3600 psi after 28 days when tested by the Contractor in conformance with the provisions in Section 90-9, "Compressive Strength, " of the Standard Specifications.

Reinforcement shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications and these special provisions.

## **Working Drawings**

The Contractor shall submit complete project specific working drawings for the micropile system to the Offices of Structure Design (OSD) in conformance with Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. Working drawings for micropiling shall be 11" x 17". For initial review, 10 sets of drawings shall be submitted. After review, between 6 and 12 sets, as requested by the Engineer, shall be submitted to OSD for final approval and use during construction. Within 3 weeks after final approval of the submittal, the Contractor shall furnish to OSD one set of final working drawings on 11" x 17" sized 20-pound (minimum) bond paper.

Working drawings for micropiling shall show the State assigned designations for the contract number, bridge number, full name of the structure as shown on the contract plans, and District-County-Route-Post Mile on each drawing and calculation sheet. The pile vendor company name, address, and phone number shall be shown on the working drawings. Each sheet shall be numbered in the lower right corner and shall contain a blank space in the upper right corner for future contract sheet numbers.

Working drawings for micropiles shall contain all information required for the construction and quality control of the piling, including the following:

- A. Information on headroom and space requirements for installation equipment that verify that the proposed equipment can perform at the site.
- B. Step-by-step procedure describing all aspects of pile installation including personnel, testing, and equipment to assure quality control. This step-by-step procedure shall be shown on the working drawings in sufficient detail so that the Engineer can monitor the construction and quality of the micropiles.
- C. Details for drilling a plumb hole.
- D. Grout mix designs.
- E. Details and procedures involved in testing components, including grout.
- F. Pipe and reinforcement splice type and locations.
- G. Details of equipment and operation for grouting. Details shall be included for monitoring grout quality, volume installed, and pressure during installation.

A supplement to the working drawings shall include construction details, structural details, and load test results from at least 3 previous successful installations by the proposed micropile vendor. The installations shall be from 3 separate test sites. The installations shall be similar to those proposed for this contract.

The working drawings and supplement shall be stamped and signed by an engineer who is licensed as a Civil Engineer in the State of California. The Engineer will notify the Contractor in writing when the submitted working drawings and supplement have been determined to be complete. The Contractor shall allow the Engineer 6 weeks to review the working drawing submittal after a complete set has been received.

No micropile shall be installed until the Engineer has approved, in writing, the working drawing submittal for micropiling.

Should the Engineer fail to review the complete working drawing submittal within the time specified, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the working drawing submittal, an extension of time commensurate with the delay in completion of the work thus caused will be granted in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

## **Construction**

Drill cuttings resulting from installing micropiling shall be disposed of in conformance with the provisions in Section 19-2.06, "Surplus Material," of the Standard Specifications. Material resulting from grouting micropiles shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications, unless otherwise permitted in writing by the Engineer.

Drilling mud or chemical stabilizers shall not be used.

Foreign material dislodged or drawn into the hole during construction of the micropiles shall be removed. Loose material existing at the bottom of the hole after drilling operations are complete shall be removed before placing grout.

The pipe shall be placed vertically and grouted in place. Grout shall be injected at the bottom of the pile and may be placed before or after placing the steel pipe.

A positive means of support shall be provided for maintaining the position of the steel pipe until the grout has set.

## **MEASUREMENT AND PAYMENT (PILING)**

Measurement and payment for the various types and classes of piles shall conform to the provisions in Sections 49-6.01, "Measurement," and 49-6.02, "Payment," of the Standard Specifications and these special provisions.

Payment for cast-in-place concrete piling shall conform to the provisions in Section 49-6.02, "Payment," of the Standard Specifications and these special provisions except that when the diameter of cast-in-place concrete piling is shown on the plans as 24 inches or larger and the pile is not a sign foundation pile, reinforcement in the piling will be paid for by the pound as bar reinforcing steel (bridge).

Full compensation for slurry, depositing concrete under slurry, test batches, inspection pipes, filling inspection holes and pipes with grout, drilling oversized cast-in-drilled-hole concrete piling, filling cave-ins and oversized piles with concrete, and redrilling through concrete shall be considered as included in the contract prices paid per linear foot for cast-in-drilled-hole concrete piling of the types and sizes listed in the Engineer's Estimate, and no additional compensation will be allowed therefor.

Full compensation for conforming to the provisions in "Steel Pipe Piling" of these special provisions shall be considered as included in the contract prices paid for the various items of work involved, and no additional compensation will be allowed therefor.

The contract price paid per linear foot for steel soldier pile of the types shown in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing the steel soldier piles at the site to the required depth, including securing the piling to maintain accurate alignment prior to and during encasing the pile with concrete, shaping pile tops, cleaning and preparing heat affected areas of piles for welding concrete anchors to the piles, furnishing pile anchors, and furnishing, cleaning, and welding concrete anchors to the piles as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Micropiles will be measured and paid for by the unit.

The contract unit price paid for micropile (NPS 12 XX-Strong) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing micropiles, including casings, grout, reinforcement, cutting tips, drill bits, pile anchorage, and disposing of materials resulting from pile installation, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

No payment will be made for micropiles that are damaged either during installation or after the micropiles are complete in place. No payment will be made for additional excavation, backfill, concrete, reinforcement, nor other costs incurred from footing enlargement resulting from replacing rejected micropiles.

### **10-1.61 DRILLED HOLES**

Holes for steel soldier piles shall be drilled into natural foundation materials at the location shown on the plans and shall conform to Section 49, "Piling," of the Standard Specifications and these special provisions.

Drilled holes shall be accurately located and shall be straight and true. When the piles are plumbed and aligned, the steel piles shall be at least one inch clear of the sides of the hole for the full length of the hole to be filled with concrete backfill and lean concrete backfill. Holes that do not provide the clearance around steel piles shall be reamed or enlarged at the Contractor's expense.

Temporary casings or tremie seals shall be furnished and placed where necessary to prevent caving of the hole.

Difficult drilling is anticipated due to the presence of caving soils and the requirements of traffic control.

Loose materials existing at the bottom of the hole after drilling operations have been completed shall be removed before placing the pile.

Materials resulting from drilling holes shall be disposed of in conformance with the provisions in Section 19-2.06, "Surplus Material," of the Standard Specifications.

Drilling mud or chemical stabilizers shall not be used. Surface water shall not be permitted to enter the hole and all water in the hole shall be removed before placing concrete therein.

Casing, if used in drilling operations, shall be removed from the hole as concrete is placed therein. The bottom of the casing shall be maintained not more than 5 feet nor less than one foot below the top of the concrete during casing withdrawal and concrete placing operations. Separation of the concrete during withdrawal operations shall be avoided by hammering or otherwise vibrating the casing. The methods used to withdraw temporary casings shall preclude contamination of the concrete and commingling of the soil and concrete or of any ground water and concrete.

The contract price paid per linear foot for drilled hole of the diameter shown on the plans shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in drilling holes for soldier piles, including disposing of the material resulting from drilled holes, dewatering, casing holes and removing casing, and providing tremie seals, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

### **10-1.62 PRESTRESSING CONCRETE**

Prestressing concrete shall conform to the provisions in Section 50, "Prestressing Concrete," of the Standard Specifications and these special provisions.

The details shown on the plans for cast-in-place prestressed box girder bridges are based on a bonded full length draped tendon prestressing system. For these bridges the Contractor may, in conformance with the provisions in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications, propose an alternative prestressing system utilizing bonded partial length tendons provided the proposed system and associated details meet the following requirements:

- A. The proposed system and details shall provide moment and shear resistances at least equal to those used for the design of the structure shown on the plans.
- B. The concrete strength shall not be less than that shown on the plans.
- C. Not less than 35 percent of the total prestressing force at any section shall be provided by full length draped tendons.
- D. Anchorage blocks for partial length tendons shall be located so that the blocks will not interfere with the placement of the utility facilities shown on the plans or of any future utilities to be placed through openings shown on the plans.
- E. Temporary prestressing tendons, if used, shall be detensioned, and the temporary ducts shall be filled with grout before completion of the work. Temporary tendons shall be either removed or fully encased in grout before completion of the work.
- F. All details of the proposed system, including supporting checked calculations, shall be included in the drawings submitted in conformance with the provisions in Section 50-1.02, "Drawings," of the Standard Specifications.

Moments and shears for loads used in the design shown on the plans will be made available to the Contractor upon written request to the Engineer.

### **10-1.63 GROSS SOLID REMOVAL SYSTEMS (GSRD's)**

#### **GENERAL**

##### **Summary**

Gross Solids Removal Systems shall consist of installing inclined and/or linear screen gross solids removal devices and appurtenances, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

##### **Submittals**

Before fabricating GSRDs, the Contractor shall submit 2 sets of working drawings to the Offices of Structure Design, Documents Unit in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. Working drawings shall include where applicable, louvered screen with louver dimensions, support heights and dimensions, jet plate, wedge wire, plate and bar dimensions, lengths, support sizes and dimensions, anchorage layouts, proposed joint locations, pattern for anchor bolts and bolted connections. Working drawings shall be supplemented with a written quality control program that includes methods, equipment, and personnel necessary to satisfy the requirements specified in these special provisions.

Working drawings shall be 22" x 34" or 11" x 17" in size and each drawing and calculation sheet shall include the State assigned designations for the contract number, GSRD type and reference as shown on the plans, and District-County-Route-Post Mile.

The Engineer will have 10 days to review the working drawings after a complete submittal has been received. Fabrication or installation of gross solids removal devices shall not be performed until the working drawings are approved in writing by the Engineer.

##### **Materials – Inclined System**

Inclined screens shall be fabricated using wedge wire with an open area of 60% to 70% of the total screen area and shall have a screen slot width between 0.17" to 0.20". Stainless steel wedge-wire screens, attaching lips, plates, and bars shall conform to the requirements of ASTM Designation: A 240/A 240M, Type 304, with a #2B finish.

Fasteners, resin capsule and mechanical expansion anchors, and cast-in-place anchor bolts shall be stainless steel (Type 304) conforming to the requirements of Section 75, "Miscellaneous Metal," of the Standard Specifications. Finished screens shall be descaled by immersion in a nitric/hydrofluoric acid bath, rinsed and air dried to achieve passivation.

### Materials – Linear System

Louvered screen, joints, supports, hatches, doors and ancillary hardware shall be constructed of stainless steel. Louvered screen tubing shall conform to the requirements of ASTM Designation: A778, and shall be Type 316L. Louvered screen shall be 0.25-inch thick louvered well screen with machine-made evenly-spaced louvered openings perpendicular to the axis of the casing. Stainless plates shall conform to the requirements of ASTM Designation: A 240/A 240M, Type 304, with a #2B finish.

Fasteners, resin capsule and mechanical expansion anchors, and cast-in-place anchor bolts shall be stainless steel (Type 304) conforming to the requirements of Section 75, "Miscellaneous Metal," of the Standard Specifications. Louvered openings shall be installed with the aperture facing away from the discharge end of the pipe. Finished screens shall be descaled by immersion in a nitric/hydrofluoric acid bath, rinsed and air dried to achieve passivation. Fabrication tolerances on the louvered screen, joints, hatches, doors shall meet the specifications shown in the table below.

Test	Test Method	Requirement
Gaps at joints of hinged sections and doors	Measured	0.20 in Max.
Size of louvers, short direction	Measured	86% within length shown on plans ±0.5
Size of louvers, long direction	Measured	86% within width shown on plans ±0.5

Screen sections shall be joined after fabrication to ensure compatibility. Sections shall be numbered using a metal tagging system after compatibility matching, with the tag indicating project location and screen number. Screen numbering shall indicate the placement at each location, with the non-louvered section being labeled as the first section and continuing sequentially until the final section for each location. The metal tags shall remain in place during after placement in the vault.

### Concrete

Concrete for GSRDs shall achieve a minimum 28-day compressive strength of 4 ksi. Portland cement concrete structures shall conform to the provisions in Section 51, "Concrete Structures," and Section 90, "Portland Cement Concrete," of the Standard Specifications and these special provisions.

### Field Quality Control

The overall vertical tolerance (plumbness from top to bottom) of the concrete walls shall not exceed 0.4 inches. The horizontal alignment tolerance of the wall shall not exceed 0.2 inches.

### Reinforcement

Reinforcement shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications and these special provisions, except for payment.

### Welding

The provisions in Section 8 -3 "Welding" of these special provisions shall not apply to GSRDs. All welding shall be performed in accordance with the "Structural Welding Code –Steel," AWS D1.1, D1.4, and D1.5. Use only welders qualified by tests in accordance with AWS B3.0.

Welding of stainless steel shall conform to the requirements of AWS D1.6. Electrodes for welding stainless steel shall be Type E308L or ER 308L filler metal for welds. After completion of the weld operation, stainless steel shall be smooth and free from waves. Weld preparation and cleaning shall be performed with stainless steel brushes and non-ferrous abrasives. Equipment used in the fabrication of carbon steel shall not be used.

Weld aluminum in accordance with the applicable requirements of the California Building Code and to the detail requirements of "Welding Aluminum," by the American Welding Society (AWS D1.2) and the Aluminum Association. All persons performing welding shall have a minimum five years similar welding experience.

Assembly of inclined screens and supports, jet plates, and ancillary features shall meet the requirements of Sections 55-3.16, "Assembly," and 55-3.17, "Welding," of the Standard Specifications.

### **Miscellaneous Metal**

Miscellaneous metal shall conform to the provisions in Section 75, "Miscellaneous Metal," of the Standard Specifications and these special provisions, except for payment.

### **Plastic Pipe**

Plastic pipe shall conform to the provisions in Section 64, "Plastic Pipe," of the Standard Specifications and these special provisions.

### **Cable Railing**

Cable railing shall conform to the provisions in Section 83, "Railings and Barriers," of the Standard Specifications and these special provisions, except for payment.

### **Fiberglass Reinforced Plastic (FRP) Gratings**

This work shall consist of furnishing, and installing FRP gratings with appurtenances in conformance with the details shown on the plans and these special provisions.

Steel gratings designated on the Gross Solid Removal Devices plans shall be FRP gratings.

FRP gratings shall be either molded or pultruded gratings. Design live load of FRP gratings for walkway applications shall be a 75 psf uniformly distributed load with a maximum deflection of 3/8 inch or 1/120 of the span length, whichever is smaller. The center of a simple span shall have a concentrated load of 250 pounds with a maximum deflection of 1/4 inch at the center of a simple span.

### **Quality Assurance**

Manufacturers experience shall be demonstrated by a record of at least 5 previous, separate, similar, and successful installations in the last 5 years.

The Contractor shall comply with the manufacturer's instructions and recommendations for work.

The Contractor shall submit working drawings of the gratings to the Offices of Structure Design, Documents Unit in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications.

Working drawings shall include, but not be limited to, material sizes, types, styles, part or catalog numbers, and complete details for the fabrication and erection of components including location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details.

The Engineer shall have 15 days to review the working drawings after a complete submittal has been received.

The Contractor shall submit the manufacturer's published literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports as applicable and design calculations for systems not sized or designed in the contract documents.

The Contractor shall submit sample pieces of each item specified in these special provisions, manufactured by the method used in the work and as to quality and color.

### **Materials**

Fiberglass reinforcement shall be continuous roving.

Fiberglass reinforcements for pultruded gratings shall include a combination of continuous strand mat and surfacing veils.

Resins shall be vinyl ester.

Finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids, and without dry spots, cracks, crazes, or unreinforced areas. Glass fibers shall be well covered with resin for protection.

Pultruded components shall contain integral UV inhibitors in the resin and a synthetic surfacing veil.

FRP products shall have a tested flame spread rating of 25 or less when tested in conformance with ASTM Designation: E-84. Upon request of the Engineer, the manufacturer shall furnish certification of ASTM E-84 testing on grating panels from an independent testing laboratory. Test data shall be from full scale testing of actual production grating of the same type of material supplied on the project. Test data performed only on the base resin shall not be acceptable.

Gratings shall have an extent of burn rate of less than or equal to 10 mm when tested in conformance with ASTM Designation: D 635.

Grating clips shall be stainless steel conforming to the requirements in ASTM Designation: A 276, Type 316 or Type 304.

After fabrication, all cut ends, holes, and abrasions of FRP grating shall be sealed with a resin approved by the grating manufacturer.

## **Fabrication**

Gratings and their components shall be shop fabricated. Each piece shall be match marked to assembly or erection drawings.

The color of the grating shall be gray.

Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts, and hardeners shall be crated or boxed separately and labeled.

Materials shall be carefully handled to protect them from damage. Store items in an enclosed area and free from contact with soil and water. Store adhesives, resins and their catalysts, and hardeners in dry indoor storage facilities between 70 and 85 degrees Fahrenheit.

Gratings shall be free from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles, and pits. Gratings shall be fabricated free from warps, twists, or other defects that affect appearance and serviceability.

Gratings shall meet minimum dimensional requirements. No field modifications for gratings shall be allowed.

Each grating section shall be readily removable, except indicated otherwise on the plans. Grating supports shall be provided at openings in the grating by the Contractor where necessary to meet load/deflection requirements specified in these special provisions. Grating openings that fit around protrusions such as pipes, cables, and machinery shall be discontinuous at approximately the centerline of opening.

Shop fabricated grating cuts shall be coated with a manufacturer approved resin at the fabrication site. Field grating cuts shall be coated with resin in accordance with the manufacturer's instructions.

Hold-down clips shall be provided and spaced at a maximum of 4 feet apart with a minimum of 4 per piece of grating, or as specified by the manufacturer.

Molded grating shall be of a one piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane. Molded gratings shall have a square mesh pattern. Molded gratings shall be reinforced with continuous roving of equal number of fiberglass filament layers in each direction. The top layer of reinforcement shall be no more than 3/16 inch below the top surface of the molded grating. Percentage of glass fibers shall not exceed 40 percent by weight.

After molding, no dry glass fibers shall be visible on the surface of bearing bars or cross bars of molded gratings. Bars shall be smooth and uniform with no evidence of fiber orientation irregularities, interlaminar voids, porosity, or resin rich or resin starved areas.

Molded gratings shall be manufactured with a concave profile on the top of each bar. Secondly applied grit will be allowed only if the top surface does not exceed 1/16 inch. Grit molded integrally during the manufacturing process will be allowed only if the top surface does not exceed 3/16 inch.

Molded grating configuration shall be 1.5 inches deep with 1.5 inches square mesh.

Pultruded grating components shall be manufactured by the pultrusion process, having a maximum of 70 percent and a minimum of 65 percent glass content by weight of continuous roving and continuous strand mat fiberglass filament reinforcement. The finished surface of the pultruded grating shall be provided with a surfacing veil to provide a resin rich surface.

Pultruded grating bearing bars shall be joined into panels, interlocked, and epoxied into the proper spacing by passing a continuous, notched cross rod or cross rods through the web of each bearing bar. The notches shall be spaced on centers to match the distance between the load bars. A continuous keeper shall be driven behind the notched cross rod to affix it into place. Chemical bonding shall complete the assembly of the cross bar system to ensure both a mechanical and chemical lock.

Pultruded gratings shall be provided with a grit bonded to the top surface of the finished grating product.

Pultruded grating configuration shall be 1.5 inches deep I-bar with 40 percent to 60 percent opening.

## **Installation**

Contractor shall install gratings in accordance with manufacturer's assembly drawings. Lock grating panels securely in place with hold-down fasteners.

FRP products shall be field cut and drilled with carbide or diamond tipped bits and blades in accordance with manufacturer's instructions. Cut or drilled surfaces shall be sealed in accordance with manufacturer's instructions.

## **EARTHWORK**

Earthwork involved in the construction of gross solids removal devices shall conform to the provisions in Section 19, "Earthwork," of the Standard Specifications, except for payment.

## Measurement and Payment

The contract unit price paid for various types of GSRDs shall include full compensation for earthwork (including structure excavation and structure backfill) and furnishing all labor, materials (including concrete, reinforcing steel, FRP grating, and miscellaneous metal), tools, equipment, and incidentals, and for doing all the work involved in constructing the GSRD, complete in place, as shown on plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for cable railing shall be considered as included in the contract unit price for the type of gross solids removal device involved, and no additional compensation will be allowed therefore.

### 10-1.64 CONCRETE STRUCTURES

Portland cement concrete structures shall conform to the provisions in Section 51, "Concrete Structures," of the Standard Specifications and these special provisions.

#### GENERAL

Concrete for structural concrete, channel invert slab, shall be Class 680-B-5000 concrete conforming to the provisions in Section 201-1, "Portland Cement Concrete," of the 2009 Edition of The "Greenbook," Standard Specifications for Public Works Construction.

Attention is directed to "Precast Concrete Quality Control" of these special provisions.

Shotcrete shall not be used as an alternative construction method for reinforced concrete members unless otherwise specified.

When a roughened concrete surface is shown on the plans, the existing concrete surface shall be roughened to a full amplitude of approximately 1/4 inch by abrasive blasting, water blasting, or mechanical equipment.

Neoprene strip shall be furnished and installed at abutment backwall joint protection at Atlantic Boulevard On-Ramp Undercrossing (Bridge Number 53-3067), Route 710/5 Separation (East) (Bridge Number 53-0785R), Route 710/5 Separation (West) (Bridge Number 53-0788L), and Whittier Boulevard Undercrossing (Bridge Number 53-1150) and at areas under precast girders and between footings and abutment wall in conformance with the details shown on the plans, the provisions in the Standard Specifications, and these special provisions.

Furnishing and installing neoprene strip shall conform to the requirements for strip waterstops as provided in Section 51-1.145, "Strip Waterstops," of the Standard Specifications, except that the protective board will not be required.

Materials for access opening covers in soffits of new cast-in-place concrete box girder bridges shall conform to the provisions for materials in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Plastic pipe located at vertical drains used behind retaining walls, including horizontal or sloping drains down slopes and across sidewalk areas, shall be polyvinyl chloride (PVC) plastic pipe, Schedule 80, conforming to the provisions for pipe for edge drains and edge drain outlets in Section 68-3.02, "Materials," of the Standard Specifications. The vertical drain pipe shall be rigidly supported in place during backfilling operations.

#### FALSEWORK

Falsework shall conform to the provisions in Section 51, "Concrete Structures," of the Standard Specifications and these special provisions.

In addition to the provisions in Section 51-1.06A, "Falsework Design and Drawings," of the Standard Specifications, the time to be provided for the Engineer's review of the working drawings for specific structures, or portions thereof, shall be as follows:

Structure or Portion of Structure	Total Review Time - Weeks
Route 710/5 Separation (East) (Bridge Number 53-0785R)	5
Route 710/5 Separation (West) (Bridge Number 53-0788L)	5

Temporary crash cushion modules, as shown on the plans and conforming to the provisions in "Temporary Crash Cushion Module" of these special provisions, shall be installed at the approach end of temporary railings which are located less than 15 feet from the edge of a traffic lane. For 2-way traffic openings, temporary crash cushion modules shall be installed at the departing end of temporary railings which are located less than 6 feet from the edge of a traffic lane.

The Contractor's engineer who signs the falsework drawings shall also certify in writing that the falsework is constructed in conformance with the approved drawings and the contract specifications prior to placing concrete. This certification shall include performing any testing necessary to verify the ability of the falsework members to sustain the stresses required by the falsework design. The engineer who signs the drawings may designate a representative to perform this certification. Where falsework contains openings for railroads, vehicular traffic, or pedestrians, the designated representative shall be qualified to perform this work, shall have at least 3 years of combined experience in falsework design or supervising falsework construction, and shall be registered as a Civil Engineer in the State of California. For other falsework, the designated representative shall be qualified to perform this work and shall have at least 3 years of combined experience in falsework design or supervising falsework construction. The Contractor shall certify the experience of the designated representative in writing and provide supporting documentation demonstrating the required experience if requested by the Engineer.

### **Welding and Nondestructive Testing**

Welding of steel members, except for previously welded splices and except for when fillet welds are used where load demands are less than or equal to 1,000 pounds per inch for each 1/8 inch of fillet weld, shall conform to AWS D1.1 or other recognized welding standard. The welding standard to be utilized shall be specified by the Contractor on the working drawings. Previously welded splices for falsework members are defined as splices made prior to the member being shipped to the project site.

Splices made by field welding of steel beams at the project site shall undergo nondestructive testing (NDT). At the option of the Contractor, either ultrasonic testing (UT) or radiographic testing (RT) shall be used as the method of NDT for each field weld and any repair made to a previously welded splice in a steel beam. Testing shall be performed at locations selected by the Contractor. The length of a splice weld where NDT is to be performed, shall be a cumulative weld length equal to 25 percent of the original splice weld length. The cover pass shall be ground smooth at the locations to be tested. The acceptance criteria shall conform to the requirements of AWS D1.1, Clause 6, for cyclically loaded nontubular connections subject to tensile stress. If repairs are required in a portion of the weld, additional NDT shall be performed on the repaired sections. The NDT method chosen shall be used for an entire splice evaluation including any required repairs.

For all field welded splices, the Contractor shall furnish to the Engineer a letter of certification which certifies that all welding and NDT, including visual inspection, are in conformance with the specifications and the welding standard shown on the approved working drawings. This letter of certification shall be signed by an engineer who is registered as a Civil Engineer in the State of California and shall be provided prior to placing any concrete for which the falsework is being erected to support.

For previously welded splices, the Contractor shall determine and perform all necessary testing and inspection required to certify the ability of the falsework members to sustain the stresses required by the falsework design. This welding certification shall (1) itemize the testing and inspection methods used, (2) include the tracking and identifying documents for previously welded members, (3) be signed by an engineer who is registered as a Civil Engineer in the State of California, (4) and shall be provided prior to erecting the members.

### **COST REDUCTION INCENTIVE PROPOSALS FOR CAST-IN-PLACE PRESTRESSED BOX GIRDER BRIDGES**

Except as provided herein, cast-in-place prestressed box girder bridges shall be constructed in conformance with the details shown on the plans and the provisions in Section 50, "Prestressing Concrete," and Section 51, "Concrete Structures," of the Standard Specifications.

If the Contractor submits cost reduction incentive proposals for cast-in-place prestressed box girder bridges, the proposals shall be in conformance with the provisions in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications and these special provisions.

The Engineer may reject any proposal which, in the Engineer's judgment, may not produce a structure which is at least equivalent to the planned structure.

At the time the cost reduction incentive proposal (CRIP) is submitted to the Engineer, the Contractor shall also submit 4 sets of the proposed revisions to the contract plans, design calculations, and calculations from an independent checker for all changes involved in the proposal, including revisions in camber, predicted deck profile at each construction stage, and falsework requirements to the Offices of Structure Design, Documents Unit, P.O. Box 942874, Sacramento, CA 94274-0001 (1801 30th Street, Sacramento, CA 95816), telephone (916) 227-8230. When notified in writing by the Engineer, the Contractor shall submit 12 sets of the CRIP plan revisions and calculations to the Offices of Structure Design for final approval and use during construction. The calculations shall verify that all requirements are satisfied. The CRIP plans and calculations shall be signed by an engineer who is registered as a Civil Engineer in the State of California.

The CRIP plans shall be either 11" x 17", or 22" x 34" in size. Each CRIP plan sheet and calculation sheet shall include the State assigned designations for the contract number, bridge number, full name of the structure as shown on the contract plans, and District-County-Route-Post Mile. Each CRIP plan sheet shall be numbered in the lower right hand corner and shall contain a blank space in the upper right hand corner for future contract sheet numbers.

Within 3 weeks after final approval of the CRIP plan sheets, one set of the corrected good quality prints on 20-pound (minimum) bond paper, 22" x 34" in size, of all CRIP plan sheets prepared by the Contractor for each CRIP shall be furnished to the Offices of Structure Design, Documents Unit.

Each CRIP shall be submitted prior to completion of 25 percent of the contract working days and sufficiently in advance of the start of the work that is proposed to be revised by the CRIP to allow time for review by the Engineer and correction by the Contractor of the CRIP plans and calculations without delaying the work. The Contractor shall allow a minimum of 12 weeks for the review of a CRIP. In the event that several CRIPs are submitted simultaneously, or an additional CRIP is submitted for review before the review of a previously submitted CRIP has been completed, the Contractor shall designate the sequence in which the CRIPs are to be reviewed. In this event, the time to be provided for the review of any proposal in the sequence shall be not less than the review time specified herein for that proposal, plus 2 weeks for each CRIP of higher priority which is still under review.

Should the review not be complete by the date specified in the Contractor's CRIP, or such other date as the Engineer and Contractor may subsequently have agreed to in writing and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in review of CRIP plans and calculations, an extension of time commensurate with the delay in completion of the work thus caused will be granted as provided in Section 8-1.07, "Liquidated Damages," of the Standard Specifications except that the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications shall not apply.

Permits and approvals required of the State have been obtained for the structures shown on the plans. Proposals which result in a deviation in configuration may require new permits or approvals. The Contractor shall be responsible for obtaining the new permits and approvals before the Engineer will reach a decision on the proposal. Delays in obtaining permits and approvals will not be reason for granting an extension of contract time.

All proposed modifications shall be designed in conformance with the bridge design specifications and procedures currently employed by the Department. The proposal shall include all related, dependent or incidental changes to the structure and other work affected by the proposal. The proposal will be considered only when all aspects of the design changes are included for the entire structure. Changes, such as but not limited to, additional reinforcement and changes in location of reinforcement, necessary to implement the CRIP after approval by the Engineer, shall be made at the Contractor's expense.

Modifications may be proposed in (1) the thickness of girder stems and deck slabs, (2) the number of girders, (3) the deck overhang dimensions as specified herein, (4) the amount and location of reinforcing steel, (5) the amount and location of prestressing force in the superstructure, and (6) the number of hinges, except that the number of hinges shall not be increased. The strength of the concrete used may be increased but the strength employed for design or analysis shall not exceed 6,000 psi.

Modifications proposed to the minimum amount of prestressing force which must be provided by full length draped tendons are subject to the provisions in "Prestressing Concrete" of these special provisions.

No modifications will be permitted in (1) the foundation type, (2) the span lengths or (3) the exterior dimensions of columns or bridge superstructure, except that the overhang dimension from face of exterior girder to the outside edge of roadway deck may be uniformly increased or decreased by 25 percent on each side of the box girder section. Fixed connections at the tops and bottoms of columns shown on the plans shall not be eliminated.

The Contractor shall be responsible for determining construction camber and obtaining the final profile grade as shown on the plans.

The Contractor shall reimburse the State for the actual cost of investigating CRIPs for cast-in-place prestressed box girder bridges submitted by the Contractor. The Department will deduct this cost from any moneys due, or that may become due the Contractor under the contract, regardless of whether or not the proposal is approved or rejected.

### **PERMANENT STEEL DECK FORMS**

Forms for the deck slabs between girders of the Los Angeles River Bridge (Bridge Number 53-0828), at the option of the Contractor, shall either be constructed and removed as provided in Section 51-1.05, "Forms," of the Standard Specifications or shall be constructed and left in place in conformance with these special provisions.

Permanent steel deck forms and supports shall be steel conforming to the requirements in ASTM Designation: A 653/A 653M (Designation SS, Grades 33 through 80) having a coating designation G165. The forms shall be mortar-tight, true to line and grade, and of sufficient strength to support the loads applied.

Detailed working drawings for forms shall be submitted to the Engineer for approval in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. Three sets of drawings shall be submitted. These drawings shall show the grade of steel, the physical and section properties for all deck members, the method of support and grade adjustment, accommodation for skew, and methods of sealing against grout leaks.

Working drawings shall be submitted sufficiently in advance of the start of the affected work to allow time for review by the Engineer and correction by the Contractor of the drawings without delaying the work. Such time shall be proportional to the complexity of the work but in no case shall such time be less than 3 weeks after complete drawings and all support data are submitted.

The design of permanent steel deck forms shall be based on the combined dead load of the forms, reinforcement, and plastic concrete plus an allowance for all anticipated construction loads. The allowance for construction loads shall be not less than 50 psf. The combined dead load shall be assumed to be not less than 160 pcf for normal concrete and not less than 130 pcf for lightweight concrete.

Physical design properties shall be computed in conformance with the requirements of the AISI specification for the "Design of Cold Formed Steel Structural Members."

The maximum allowable stresses and deflections used in the design of steel forms shall be as follows:

- A. Tensile stress shall not exceed 0.725 of the specified yield strength of the material furnished or 36,000 psi.
- B. Deflection due to dead load shall not exceed 0.0056 of form span or 1/2 inch, whichever is less. In no case shall the dead load for deflection calculations be less than 120 psf total.
- C. Form camber, used at the option of the Contractor, shall be based on the actual dead load condition. Camber shall not be used to compensate for deflection in excess of the allowable limits.
- D. The design span of the form sheets shall be the clear span of the form plus 2 inches measured parallel to the form flutes.

Permanent steel deck forms shall not be used for those sections of deck slabs that contain a longitudinal expansion joint unless additional supports are placed under the joint.

Permanent steel deck forms shall not be welded to the flanges of girders.

Permanent steel deck forms shall not interfere with the movement at deck expansion joints.

The clearance between the surface of permanent forms and any bar reinforcement shall be not less than one inch. The configuration of the forms shall be such that the weight of deck slab is not more than 110 percent of the weight of the total deck slab as dimensioned on the plans.

Permanent steel deck forms shall be installed in conformance with the approved working drawings.

Form sheets shall not rest directly on the top of the girder flanges. Sheets shall be securely fastened to form supports and shall have a minimum bearing length of one inch at each end. Form supports shall be placed in direct contact with the flange of the girder. Attachment of supports shall be made by bolts, clips or other approved means.

Transverse deck construction joints shall be located at the bottom of a flute and 1/4-inch weep holes shall be field drilled at not less than 12 inches on center along the line of the joint.

Permanently exposed galvanized form surfaces that are abraded or damaged prior to installation shall be repaired by thoroughly wire brushing the damaged areas and removing all loose and cracked coating, after which the cleaned areas shall be painted with 2 applications of unthinned zinc-rich primer (organic vehicle type) conforming to the provisions in Section 91, "Paint," of the Standard Specifications. Aerosol cans shall not be used. Minor heat discoloration in area of welds need not be repaired.

### **DECK CLOSURE POURS**

Where a deck closure pour is shown on the plans, reinforcement protruding into the closure space and forms for the closure pour shall conform to the following:

- A. During the time of placement of concrete in the deck, other than for the closure pour itself, reinforcing steel which protrudes into the closure space shall be completely free from any connection to the reinforcing steel, concrete, or other attachments of the adjacent structure, including forms. The reinforcing steel shall remain free of any connection for a period of not less than 24 hours following completion of the pour.
- B. Forms for the closure pour shall be supported from the superstructure on both sides of the closure space.

### **SLIDING BEARINGS**

Sliding bearings consisting of elastomeric bearing pads lubricated with grease and covered with sheet metal shall conform to the following requirements:

- A. Grease shall conform to the requirements of Society of Automotive Engineers AS 8660. A uniform film of grease shall be applied to the upper surface of the pads prior to placing the sheet metal.
- B. Sheet metal shall be commercial quality galvanized sheet steel. The sheet metal shall be smooth and free of kinks, bends, or burrs.
- C. Construction methods and procedures shall prevent grout or concrete seepage into the sliding bearing assembly.

### **ELASTOMERIC BEARING PADS**

Elastomeric bearing pads shall conform to the provisions in Section 51-1.12H, "Elastomeric Bearing Pads," of the Standard Specifications.

## **PRECAST PRESTRESSED CONCRETE BRIDGE MEMBERS**

Before curing operations, the top surface of each member shall be given a coarse texture by brooming with a stiff bristled broom or by other suitable devices that will result in uniform transverse scoring.

When rectangular girders or U girders with a concrete deck are shown on the plans, surfaces to be given a coarse broom finish shall be cleaned of surface laitance and curing compound before placing deck concrete. Exposure of clean aggregate will not be required.

The anticipated deflection and method of accommodation of deflection of precast prestressed concrete girders, prior to the time the deck concrete is placed, shall be shown on the working drawings in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The deflection shall include the following:

- A. Anticipated upward deflection caused by the prestressing forces.
- B. Downward deflection caused by the dead load of the girder.
- C. Deflection caused by the creep and shrinkage of the concrete for the time interval between the stressing of the girders and the planned placement of the deck.

The deflection shall be substantiated by calculations that consider the ages of the girder concrete at the time of stressing and the Contractor's planned placement of the deck. Deflection calculations shall be based on the concrete producer's estimate of the modulus of elasticity at the applicable concrete age.

Adjustments to accommodate girder deflections that occur prior to the time the deck concrete is placed may include revisions in bearing seat elevations, but the adjustments shall be limited by the following conditions:

- A. The minimum permanent vertical clearance under the structure as shown on the plans shall not be reduced.
- B. The profile grade and cross slope of the deck shall not be changed.

Girders with unanticipated girder deflection that do not comply with conditions A, B, and C will be rejected in conformance with the provisions in Section 6-1.04, "Defective Materials," of the Standard Specifications.

Adjustments to accommodate girder deflections will not be considered a change in dimensions. Full compensation for increases in the cost of construction, including increases in the quantity of deck or bearing seat concrete, resulting from adjustments to accommodate girder deflections shall be considered as included in the contract prices paid for the various items of work involved, and no additional compensation will be allowed therefor.

The Contractor shall submit a girder erection plan to the Engineer for approval in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The girder erection plan shall include procedures, details, and sequences for unloading, lifting, erecting, and installing temporary bracing, and shall be signed by an engineer who is registered as a Civil Engineer in the State of California. The Contractor shall allow 20 days for the review of the girder erection plan.

## **MEASUREMENT AND PAYMENT**

Measurement and payment for concrete in structures shall conform to the provisions in Section 51-1.22, "Measurement," and Section 51-1.23, "Payment," of the Standard Specifications and these special provisions.

Full compensation for roughening existing concrete surfaces to a full amplitude of approximately 1/4 inch, where shown on the plans, shall be considered as included in the contract price paid per cubic yard for structural concrete, bridge and no separate payment will be made therefor.

Full compensation for furnishing and installing access opening covers in soffits of new cast-in-place box girder bridges shall be considered as included in the contract price paid per cubic yard for structural concrete, bridge and no separate payment will be made therefor.

Full compensation for furnishing and installing plastic pipe located at vertical drains used behind retaining walls, including horizontal drains, including excavation and backfill involved in placing the plastic pipe, shall be considered as included in the contract price paid per cubic yard for the various items of concrete work involved and no separate payment will be made therefor.

Full compensation for furnishing and constructing permanent steel deck forms shall be considered as included in the contract price paid per cubic yard for structural concrete, bridge and no additional compensation will be allowed therefor.

Full compensation for public notification and airborne monitoring for deck crack treatment shall be considered as included in the contract price paid per cubic yard for structural concrete, bridge, and no additional compensation will be allowed therefor.

### 10-1.65 PRECAST PRESTRESSED CONCRETE PAVEMENT

Precast prestressed concrete pavement (PPCP) shall conform to the provisions in Section 40, "Portland Cement Concrete Pavement," Section 50, "Prestressing," and Section 51, "Concrete Structures," of the Standard Specifications and these special provisions.

#### GENERAL

Reference items and materials for panels shall conform to the requirements in Section 41, "Pavement Subsealing And Jacking," Section 50, "Prestressing Concrete," Section 51, "Concrete Structures," Section 52, "Reinforcement," Section 90, "Portland Cement Concrete," and Section 95, "Epoxy" of the Standard Specifications.

#### MATERIALS AND FABRICATION

"Panel" shall refer to individual precast prestressed concrete panels, including base panels, joint panels, and central stressing panels. "Slab" shall refer to a post-tensioned section of precast panels between expansion joints.

Concrete for PPCP shall have a minimum compressive strength of 6000 PSI at 28 days.

Prestressing steel in PPCP panels shall not be cut or released until the concrete in the panel has attained a compressive strength of not less than 4000 PSI.

Concrete mix shall be fiber reinforced and proportioned conforming to the requirements for precast concrete in Section 90, "Portland Cement Concrete," and strength requirements in these special provisions.

Plain reinforcement shall be Grade 60.

Transverse pretensioning strand shall be 13-mm diameter, conforming to ASTM Designation: A 416, Grade 270 (low relaxation).

Longitudinal post-tensioning strand shall be 16 mm diameter epoxy coated with or without grit impregnation, conforming to the requirements of ASTM Designation A 882.

Post-tensioning ducts shall remain straight in forms during casting (loose bar stiffeners may be used to keep ducts straight during concrete placement). Ducts shall be rigid plastic or galvanized conforming to the requirements for ducts in Section 50, "Prestressing Concrete," of the Standard Specifications.

Grout vents shall be located in the joint panels and central stressing panels as shown on the panel detail sheets. Additional grout vents shall be located in the base panels (as shown on the panel detail sheets) located at the mid-point between joint panels and central stressing panels. The distance between grout vents shall not exceed 50 ft.

TABLE OF ALLOWABLE TOLERANCES

Length (Longitudinal to C/L)	+ 1/4 inch
Width (Transverse to C/L)	+ 1/4 inch
Nominal Thickness	+ 1/16 inch
Horizontal Alignment (Upon release of prestress) – deviation from straightness of mating edge of panels	+ 1/8 inch
Deviation of ends from shop plan dimension (Horizontal Skew)	+ 1/8 inch
Position of Strands	+ 1/8 inch Vertical + 1/8 inch Horizontal
Position of post-tensioning ducts at transverse joints	+ 1/8 inch Vertical + 1/8 inch Horizontal
Straightness of post-tensioning ducts	+ 1/4 inch
Squareness (corner-corner measurement)	+ 1/8 inch
Position of lifting anchors	+ 3 inches
Note: *Measured from bottom of panel	

#### CONSTRUCTION

The top surface of the pavement shall be given a coarse texture by brooming with a stiff bristled broom or by other suitable devices that will result in uniform longitudinal scoring, in advance of curing operations. The requirements of the seventh paragraph of Section 51-1.17, "Finishing Bridge Decks," of the Standard Specifications shall not apply.

After the concrete slabs are in final position, tendon ducts shall be filled with mortar.

Access pockets shall be filled with Class 1 concrete produced from aggregate with a 25-mm, maximum grading. Concrete penetration shall be near the lower limit of the specified nominal penetration. Access pockets shall be mortar-tight before placing concrete. Concrete shall be thoroughly consolidated.

Panels must be steam cured.

Pavement dowels must be epoxy coated or stainless steel and conform to Section 52, "Reinforcement" of the Standard Specifications. Dowel expansion sleeves must be stainless steel. Grease the section of dowel extending into the expansion sleeve prior to being inserted in the expansion sleeve prior to casting.

Locate lifting devices approximately 0.2 X L from the panel edges as shown on the panel detail sheets. Lifting devices must not protrude from the panel surface.

Repair panels damaged during removal from forms and handling on a case-by-case basis. Repairs are required when the surface of the panel or the keyed panel edges are damaged and will affect ride quality, assembly of the panels, or long-term performance of the pavement. Repairs to keyways and adjoining edges of panels must not protrude past the adjacent true edges of the keyway and panel edge.

Place polyethylene sheeting on existing or reconstructed base prior to installing PPCP.

Polyethylene sheeting between panels and lean concrete base rapid setting (LCBRS) must be 6 mils or thicker, and conform to the requirements of ASTM Designation C 171, white opaque.

Panels must be temporarily post-tensioned together during placement to ensure closure of transverse joints prior to final post-tensioning. Use elongated pockets cast into joint panels at third points to accommodate the post-tensioning ram for temporary post-tensioning when placing panels between the joint panels and central stressing panels. Use central stressing pockets for temporary post-tensioning when placing panels between the central stressing panels and final joint panel. Use 7-wire strand, 1/2 inch or 3/8 inch diameter for temporary post-tensioning. Do not place more than three panels between temporary post-tensioning operations. Prevent damage to the keyways during temporary post-tensioning.

Seal transverse joints between panels to prevent intrusion of water and corrosive agents with epoxy using one or both of the following methods:

- A. Slow-setting (24 hour set) epoxy resin adhesive for bonding new concrete to new concrete shall be applied to the entire surface of the keyed joints of mating panels, ensuring epoxy is not applied within 1/2 inch of the duct openings.
- B. Epoxy injected into transverse joints after completion of post-tensioning and grouting to seal the joint from water intrusion.

Seal the post-tensioning ducts at the transverse joints to prevent grout leakage using one or both of the following methods:

- A. Place a compressible foam or neoprene gasket around the opening of each post-tensioning duct, around each duct opening. The seal must be continuous, not compressible to a thickness less than 1/8 inch and not cover any part of the duct opening nor inhibit the flow of grout through the duct.
- B. Place a sleeve extending from the post-tensioning ducts of the panel being placed, to extend into the ducts of the mating panel already in place. The sleeve must not inhibit insertion of the post-tensioning strands or the flow of grout through the duct.

Complete post tensioning of a slab no more than 3 days after placement of the panels if the panels are opened to traffic prior to post-tensioning. If slow-setting epoxy is applied to the keyed panel joints, complete post-tensioning prior to the specified final set time of the epoxy, and no more than 24 hours after panel placement began.

Fill central stressing pockets and anchorage access pockets only after completion of post-tensioning and prior to grouting the post-tensioning tendons. Fill the pockets with accelerated strength, low shrink concrete if the finished pavement is to be opened to traffic within 3 hours of Filling. Make alternative provisions to close the pockets with temporarily covers to withstand traffic loading. Fasten the temporary covers to the panels so they are not disturbed by traffic and are flush with the surface of the pavement. Finish the concrete surface to match the surface of the surrounding panel. Repair concrete shrinkage and surface cracks with high molecular weight methacrylate resin.

Grout the post-tensioning ducts after post-tensioning is complete and pockets are filled. Complete grouting as soon as possible, but not more than 7 days, after completion of post-tensioning. Grouting may be completed prior to opening to traffic.

Complete underslab grouting using the vents shown on the plans after pockets have been filled. Comply with materials and procedures in Section 41, "Pavement Subsealing and Jacking," except for the requirements for drilling holes, in Section 41-1.03. The Engineer determines if underslab-grouting must occur prior to opening to traffic, if there are significant voids are noticed beneath panels during placement, The Engineer orders compressible foam gaskets attached to the bottom of each panel to prevent grout leakage around the perimeter of the panel. Gaskets must compress and not affect the finished elevation of the pavement.

Dowel bars extending from the cast-in-place pavement at either end of the precast pavement section shall be Grade 60 epoxy coated as shown on the plans and installed in the cast-in-place pavement in conformance with these special provisions.

Grout dowel bar slots in the precast concrete pavement and cast-in-place concrete pavement as soon as possible after panel placement and prior to opening to traffic. Grout dowel bar slots in accordance with Section 41, "Pavement Subsealing and Jacking."

Place dowels and longitudinal isolation joints to conform to the details shown for jointed plain concrete pavement, and requirements in these special provisions.

Profile the pavement surface not more than 10 days following placement, The Profile Index requirements of Section 40 shall apply:

Profile concrete shoulders within the shoulder, one foot from and parallel with each edge of the shoulder.

Seal expansion joints with Type B preformed elastomeric joint seal as specified in Section 51, "Concrete Structures," of the Standard Specifications. Joint seal must accommodate a total movement of 1 inch. Follow the manufacturer's specifications for groove dimensions and installation width of the joint seal. Adjust the width of the expansion joint on-site based upon the approximate ambient temperature at post-tensioning according to:

Ambient Temperature (Ta)	48 foot Slab Length
Ta < 59°C	1 inch
59°C < Ta < 115°C	½ inch
Ta > 115°C	0 inch

## MEASUREMENT AND PAYMENT

Precast prestressed concrete pavement will be measured by the cubic yard for precast prestressed concrete pavement

The contract price paid per cubic yard for precast prestressed concrete pavement shall include full compensation for furnishing all labor, testing, materials, (including reinforcing and prestressing steel), temporary and final post-tensioning steel, lifting anchors, tools, equipment, epoxy incidentals, approved shop drawings, and for doing all the work involved in constructing, furnishing, transporting and installing precast prestressed concrete pavement as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for furnishing and placing concrete and temporary covers in access pockets, furnishing and placing gaskets, sleeves and grout in ducts, and underslab gaskets and grout shall be considered as included in the contract price paid per cubic yard for precast prestressed concrete-pavement and no additional compensation will be allowed therefor.

### 10-1.66 STRUCTURE APPROACH SLABS (TYPE N)

#### GENERAL

##### Summary

This work includes constructing reinforced concrete approach slabs, structure approach drainage systems, and treated permeable base.

Reinforced concrete approach slabs must comply with Section 51, "Concrete Structures," of the Standard Specifications.

##### Submittals

Furnish a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for the geocomposite drain certifying that the drain complies with these special provisions. The Certificate of Compliance must be accompanied by a flow capability graph for the geocomposite drain showing flow rates and the externally applied pressures and hydraulic gradients. The flow capability graph must be stamped with the verification of an independent testing laboratory.

Notify the Engineer of the type of treated permeable base to be furnished at least 30 days before the start of placement. Once you have notified the Engineer of the selection, the type to be furnished must not be changed without a prior written request to do so and approval thereof by the Engineer.

Notify the Engineer of the source of woven tape fabric at least 45 days before use.

#### MATERIALS

##### Concrete

Concrete for structure approach slabs must contain not less than 675 pounds of cementitious material per cubic yard and must either:

1. Cure for not less than 5 days before opening to public traffic, or
2. Comply with "Rapid Strength Concrete for Structures" of these special provisions.

##### Drainage Pads

Concrete for use in drainage pads must be minor concrete, except the concrete must contain not less than 505 pounds of cementitious material per cubic yard.

### **Geocomposite Drain**

Geocomposite drain must consist of a manufactured core not less than 0.25 inch thick nor more than 2 inches thick with one or both sides covered with a layer of filter fabric that will provide a drainage void. The drain must produce a flow rate through the drainage void of at least 2 gallons per minute per foot of width at a hydraulic gradient of 1.0 and a minimum externally applied pressure of 3,500 psf.

The manufactured core must be one of the following:

1. Preformed grid of embossed plastic
2. Mat of random shapes of plastic fibers
3. Drainage net consisting of a uniform pattern of polymeric strands forming 2 sets of continuous flow channels
4. System of plastic pillars and interconnections forming a semirigid mat

The core material and filter fabric must be capable of maintaining the drainage void for the entire height of geocomposite drain. Filter fabric must be integrally bonded to the side of the core material with the drainage void.

### **Filter Fabric**

Filter fabric must comply with the specifications for Class A filter fabric in Section 88-1.02, "Filtration," of the Standard Specifications.

### **Treated Permeable Base**

Treated permeable base under structure approach slabs must be an asphalt treated permeable base or a cement treated permeable base as specified in Section 29, "Treated Permeable Bases," of the Standard Specifications.

### **Miscellaneous Materials**

Steel components of abutment ties, including plates, nuts, washers, and rods, must comply with Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Steel angles, plates, and bars at the concrete barrier joints must comply with Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Hardboard and expanded polystyrene must comply with Section 51-1.12D, "Sheet Packing, Preformed Pads, and Board Fillers," of the Standard Specifications.

Building paper must be commercial quality 30-pound asphalt felt.

PVC conduit used to encase the abutment tie rod must be commercial quality.

## **CONSTRUCTION**

### **Geocomposite Drain**

Install the geocomposite drain with the drainage void and the filter fabric facing the embankment. The fabric facing the embankment side must overlap a minimum of 3 inches at all joints and wrap around the exterior edges a minimum of 3 inches beyond the exterior edge. If additional fabric is needed to provide overlap at joints and wraparound at edges, the added fabric must overlap at least 6 inches and be attached to the fabric on the geocomposite drain.

Place core material manufactured from impermeable plastic sheeting having non-connecting corrugations with the corrugations approximately perpendicular to the drainage collection system.

If the fabric on the geocomposite drain is torn or punctured, replace the damaged section completely or repair it by placing a piece of fabric that is large enough to cover the damaged area and provide a 6-inch overlap.

If asphalt treated permeable base is placed around the slotted plastic pipe at the bottom of the geocomposite drain, it must be placed at a temperature of not less than 180 °F nor more than 230 °F.

### **Filter Fabric**

Place filter fabric immediately after grading and compacting the subgrade to receive the filter fabric.

Align, handle, and place filter fabric in a wrinkle-free manner under the manufacturer's recommendations.

Adjacent borders of the filter fabric must be overlapped from 12 inches to 18 inches or stitched. The preceding roll must overlap the following roll in the direction the material is being spread or must be stitched. When the fabric is joined by stitching, it must be stitched with yarn of a contrasting color. The size and composition of the yarn must be as recommended by the fabric manufacturer. The number of stitches per 1 inch of seam must be 5 to 7.

Equipment or vehicles must not be operated or driven directly on the filter fabric.

### Woven Tape Fabric

Woven tape fabric to be placed between the treated permeable base and the approach slab must be a fabric made of woven strips or tapes and shall conform to the following:

Property	ASTM Designation	Requirement
Weight, ounces per square yard, min.	D 3776	3
Grab Tensile Strength, pounds, min.	D 4632	50
Elongation, percent, max.	D 4632	35
Toughness, pounds, min. (Percent elongation times grab tensile strength)	----	1,200

Woven tape fabric must be treated to provide a minimum of 70 percent breaking strength retention after 500 hours exposure when tested under ASTM D 4355.

### Treated Permeable Base

Construct treated permeable base under Section 29, "Treated Permeable Bases," of the Standard Specifications and these special provisions.

Place asphalt treated permeable base at a temperature of not less than 200 °F nor more than 250 °F. Do not use material stored in excess of 2 hours in the work.

Asphalt treated permeable base may be spread in 1 layer. Compact with a vibrating shoe type compactor or a roller weighing at least 1.5 tons but not more than 5 tons. Begin compacting base as soon as the mixture has cooled sufficiently to support the weight of the equipment without undue displacement.

Cement treated permeable base may be spread in 1 layer. Compact base with a vibrating shoe type compactor or with a steel-drum roller weighing at least 1.5 tons but not more than 5 tons. Compaction must begin within one-half hour of spreading and must consist of 2 complete coverages of the cement treated permeable base.

### Finishing Approach Slabs

Finish and treat the top surface of approach slabs under Section 51-1.17, "Finishing Bridge Decks," of the Standard Specifications. Edges of slabs must be edger finished.

Cure approach slabs with pigmented curing compound (1) under the specifications for curing structures in Section 90-7.01B, "Curing Compound Method," of the Standard Specifications.

### Sealing Joints

Type AL joint seals must comply with Section 51-1.12F, "Sealed Joints," of the Standard Specifications. The sealant may be mixed by hand-held power-driven agitators and placed by hand methods.

The pourable seal between the steel angle and concrete barrier must comply with the requirements for Type A and AL seals in Section 51-1.12F(3), "Materials and Installation," of the Standard Specifications.

The sealant may be mixed by hand-held power-driven agitators and placed by hand methods. Immediately before placing the seal, thoroughly clean the joint, including abrasive blast cleaning of the concrete surfaces, so that all foreign material and concrete spillage are removed from all joint surfaces. Joint surfaces must be dry at the time the seal is placed.

### MEASUREMENT AND PAYMENT

Structural concrete, approach slab (Type N) will be measured and paid for in conformance with the provisions in Section 51-1.22, "Measurement," and Section 51-1.23, "Payment," of the Standard Specifications and these special provisions.

Full compensation for the structure approach drainage system including geocomposite drain, plastic pipe, and drainage pads, treated permeable base, filter fabric, woven tape fabric, miscellaneous metal, and pourable seals, shall be considered as included in the contract price paid per cubic yard for structural concrete, approach slab of the type shown in the Engineer's Estimate, and no additional compensation will be allowed therefor.

### 10-1.67 STRUCTURE APPROACH SLABS (TYPE R)

#### GENERAL

##### Summary

This work includes removing portions of existing pavement and base including reinforced concrete approach slabs, asphalt concrete surfacing, portland cement concrete pavement, subsealing material, and cement treated base, and constructing new reinforced concrete approach slabs at structure approaches.

Reinforced concrete approach slabs must comply with Section 51, "Concrete Structures," of the Standard Specifications.

## **Quality Control and Assurance**

### **Trial Slab**

Before beginning work on approach slabs constructed using RSC, you must successfully complete one or more trial slabs for each concrete mix design to be used in constructing the approach slabs.

Trial slabs must be constructed, finished, cured, and tested with the materials, tools, equipment, personnel, and methods to be used in completing the approach slab. Trial slabs must demonstrate that you are capable of producing approach slabs in conformance with the provisions in this section, within anticipated time periods including delivery, placement, finishing, and curing times, and under similar atmospheric and temperature conditions expected during construction operations. Multiple trial slabs for each approach slab concrete mix design may be required to envelop variable atmospheric conditions.

The minimum trial slab dimensions must be 10' x 20' x 9". Place trial slabs near the job site at a location acceptable to the Engineer except slabs must not be placed on the roadway or within the project limits.

Perform compressive strength testing under Section 90-9, "Compressive Strength," of the Standard Specifications. Trial slab concrete must develop compressive strengths of at least 1200 psi at the age of break used for prequalification of the concrete, and at least 2500 psi at 3 days.

## **MATERIALS**

### **Concrete**

Concrete for structure approach slabs must contain not less than 675 pounds of cementitious material per cubic yard and must either:

1. Cure for not less than 5 days before opening to public traffic, or
2. Comply with "Rapid Strength Concrete for Structures" of these special provisions.

### **Temporary Structural Section**

HMA must consist of commercial quality aggregate and asphalt binder. The grading of the aggregate must comply with the 3/4-inch HMA Types A and B grading specified in Section 39-1.02E, "Aggregate," of the Standard Specifications. The asphalt binder must comply with the requirements for liquid asphalt SC-800 in Section 93, "Liquid Asphalts," of the Standard Specifications. The amount of asphalt binder to be mixed with the aggregate must be approximately 0.3 percent less than the optimum bitumen content as determined by California Test 367.

### **Aggregate Base (Approach Slab)**

Aggregate base (approach slab) for filling voids below the reinforced structure approach slab concrete must be produced from commercial quality aggregates consisting of broken stone, crushed gravel or natural rough-surfaced gravel, and sand, or any combination thereof. The grading of the aggregate base must comply with the 3/4-inch maximum grading specified in Section 26-1.02A, "Class 2 Aggregate Base," of the Standard Specifications.

### **Miscellaneous Materials**

Steel components of abutment ties, including plates, nuts, washers, and rods, must comply with Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Steel angles, plates, and bars at the concrete barrier joints must comply with Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Hardboard and expanded polystyrene must comply with Section 51-1.12D, "Sheet Packing, Preformed Pads, and Board Fillers," of the Standard Specifications.

Building paper must be commercial quality 30-pound asphalt felt.

PVC conduit used to encase the abutment tie rod must be commercial quality.

## **CONSTRUCTION**

### **General**

The thickness shown on the plans for structure approach slabs is the minimum thickness. The thickness may vary depending on the thickness of the pavement and base materials removed.

Dispose of all materials no longer required in the work under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Schedule your work so that the pavement and base materials removed during a work period are replaced in that same work period with properly finished and cured approach slab concrete before the time the lane is to be opened to public traffic as specified in "Maintaining Traffic" of these special provisions.

If the existing pavement and base materials are removed, and you are unable to construct, finish, and cure the new approach slab by the time the lane is to be opened to public traffic, you must fill the excavation with a temporary roadway structural section as specified in this section, "Structure Approach Slabs (Type R)."

### **Temporary Roadway Structural Section**

Provide a standby quantity of hot mix asphalt (HMA) and aggregate base at the job site equal to the quantity of pavement removed during the work shift for construction of a temporary roadway structural section. The temporary structural section must consist of a 0.3-foot-thick layer of HMA over aggregate base.

Spread and compact aggregate base and HMA by methods that will produce a well-compacted, uniform base, free from pockets of coarse or fine material and a surfacing of uniform smoothness, texture, and density. The aggregate base and the HMA may each be spread and compacted in one layer. The finished surface of the HMA must not vary more than 0.05 foot from the lower edge of a 12-foot straightedge placed parallel with the centerline and must match the elevation of the existing pavement and structure along the joints between the existing pavement and structure and the temporary surfacing.

Maintain the temporary structural section until you are able to construct and cure the approach slab with the prescribed time limit.

### **Removing Existing Pavement And Base Materials**

Sawcut full depth the outline of portland cement concrete to be removed with a power-driven concrete saw.

Cut the outlines of excavations in asphalt concrete on a neat line to a minimum depth of 0.25 foot with a power-driven concrete saw or wheel-type rock cutting excavator before any asphalt concrete material is removed. These excavations must be permanently or temporarily backfilled to conform to the grade of the adjacent pavement before opening the lane to public traffic. Surplus excavated material may be used as temporary backfill material.

Regardless of the type of equipment used to remove concrete within the sawed outline, do not use power impact tools within 1.5 feet of the pavement that is required to remain in place.

Uniformly grade and compact the existing base material remaining in place after removing the existing pavement and base materials to the required depth. The finished surface of the base material at any point must not extend above the grade approved by the Engineer.

Fill areas of base material that are low as a result of over excavation with structure approach slab concrete in the same operation that the new concrete is placed.

Where pavement subsealing has been performed under existing approach slabs, remove the full depth of subsealing material. Where removal of cement treated base is required to construct the approach slab, remove the full depth of the cement treated base.

Fill voids between the new structure approach slab and the base material remaining in place that are caused by removal of subsealing material or cement treated base with either aggregate base (approach slab) or structure approach slab concrete. If you choose to fill these voids with structure approach slab concrete, fill the voids in the same operation that the new concrete is placed.

Establish a grade line for the new approach slab that will provide a smooth profile grade. The profile grade will be subject to approval by the Engineer.

### **Aggregate Base (Approach Slab)**

Spread and compact aggregate base (approach slab) for filling voids below the reinforced structure approach slab concrete by methods that will produce a well-compacted, uniform base, free from pockets of coarse or fine material to the grade approved by the Engineer. Where the required thickness of aggregate base is 8 inches or less, the base may be spread and compacted in one layer. Where the required thickness of aggregate base is more than 8 inches, the base must be spread and compacted in 2 or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 8 inches.

The finished surface of the base material at any point must not extend above the grade approved by the Engineer. Fill areas of base material that are lower than the grade approved by the Engineer with structure approach slab concrete in the same operation that the new concrete is placed.

### **Bonding Bar Reinforcement**

Bond bar reinforcement or abutment tie rods in drilled holes under the provisions for drilling and bonding dowels in Section 83-2.02D(1), "General," of the Standard Specifications.

If reinforcement is encountered during drilling before the specified depth is attained, notify the Engineer. Unless the Engineer approves coring through the reinforcement, the hole will be rejected and a new hole must be drilled adjacent to the rejected hole to the depth shown on the plans.

### **Finishing Approach Slabs**

Finish the top surface of the approach slab under the provisions for decks in Section 51-1.17, "Finishing Bridge Decks," of the Standard Specifications. The finished top surface must not vary more than 0.02 foot from the lower edge of a 12-foot straightedge placed parallel with the centerline. Edges of slabs must be edger finished. The provisions for deck crack treatment do not apply to Type R approach slabs.

The surface of the approach slab will not be profiled, and the Profile Index requirements do not apply.

Approach slab concrete shall be cured before the time the lane is to be opened to public traffic as specified in "Maintaining Traffic" of these special provisions.

### **Sealing Joints**

Type AL joint seals must comply with Section 51-1.12F, "Sealed Joints," of the Standard Specifications. The sealant may be mixed by hand-held power-driven agitators and placed by hand methods.

The pourable seal between the steel angle and concrete barrier must comply with the requirements for Type A and AL seals in Section 51-1.12F(3), "Materials and Installation," of the Standard Specifications. The sealant may be mixed by hand-held power-driven agitators and placed by hand methods. Immediately before placing the seal, thoroughly clean the joint, including abrasive blast cleaning of the concrete surfaces, so that all foreign material and concrete spillage are removed from all joint surfaces. Joint surfaces must be dry at the time the seal is placed.

### **MEASUREMENT AND PAYMENT**

Structural concrete, approach slab (Type R) will be measured and paid for in conformance with the provisions in Section 51-1.22, "Measurement," and Section 51-1.23, "Payment," of the Standard Specifications and these special provisions.

Full compensation for removing and disposing of portions of existing pavement materials, and for furnishing and placing Type AL joint seals, and pourable seals shall be considered as included in the contract price paid per cubic yard for structural concrete, approach slab (Type R), and no separate payment will be made therefor.

The quantity of aggregate base (approach slab) to be paid for shall include the actual volume of aggregate base (approach slab) used to fill voids below the reinforced structure approach slab concrete, except for the volume of areas low as a result of over excavation. The volume to be paid for will be calculated on the basis of the constructed length, width, and thickness of the filled voids. Structure approach slab concrete used to fill voids lower than the approved grade of the base, except for the areas low as a result of over excavation, will be measured and paid for by the cubic yard as aggregate base (approach slab).

The contract price paid per cubic yard for aggregate base (approach slab) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing aggregate base (approach slab), complete in place, including excavation and removing and disposing of base and subsealing materials, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for furnishing, stockpiling, and disposing of standby material for construction of temporary structural sections; and for constructing, maintaining, removing, and disposing of temporary structural sections shall be considered as included in the contract price paid per cubic yard for structural concrete, approach slab (Type R), and no separate payment will be made therefor.

Full compensation for drilling and bonding of bar reinforcement or abutment tie rods shall be considered as included in the contract price paid per cubic yard for structural concrete, approach slab (Type R), and no separate payment will be made therefor.

Full compensation for constructing, testing, and removing trial slabs shall be considered as included in the contract price paid per cubic yard for structural concrete, approach slab (Type R), and no separate payment will be made therefor.

### **10-1.68 PAVING NOTCH EXTENSION**

This work shall consist of extending existing paving notches in conformance with the details shown on the plans and these special provisions.

Concrete for paving notch extension shall be a high-strength material consisting of either magnesium phosphate concrete, modified high alumina based concrete, or portland cement based concrete. Magnesium phosphate concrete shall conform to the provisions for magnesium phosphate concrete in Section 83-2.02D(1), "General," of the Standard Specifications and these special provisions. Modified high alumina based concrete and portland cement based concrete shall be water activated and shall conform to the provisions for single component (water activated) magnesium phosphate concrete in Section 83-2.02D(1), "General," of the Standard Specifications and these special provisions.

At least one hour shall elapse between the time of placing concrete for the paving notch extension and placing concrete for the structure approach slab.

A clean, uniform, rounded aggregate filler may be used to extend the concrete. The moisture content of the aggregate shall not exceed 0.5 percent. Grading of the aggregate shall conform to the following:

Sieve Sizes	Percentage Passing
1/2"	100
No. 16	0-5

The amount of aggregate filler shall conform to the manufacturer's recommendation, but in no case shall the concrete strengths be less than that specified for magnesium phosphate concrete in Section 83-2.02D(1), "General," of the Standard Specifications.

The components of dual component (with a prepackaged liquid activator) magnesium phosphate shall be combined by mixing complete units supplied by the manufacturer. Portions of units shall not be used. Water shall not be added to dual component magnesium phosphate.

Magnesium phosphate concrete shall not be mixed in containers or worked with tools containing zinc, cadmium, aluminum or copper. Modified high alumina based concrete shall not be mixed in containers or worked with tools containing aluminum.

Concrete shall not be retempered. Finishing tools that are cleaned with water shall be thoroughly dried before working the concrete.

When placing concrete on slopes exceeding 5 percent, the Engineer may require the Contractor to provide a flow controlled modified material.

Modified high alumina based concrete and portland cement based concrete shall be cured in conformance with the provisions in Section 90-7.01B, "Curing Compound Method," of the Standard Specifications. Magnesium phosphate concrete shall not be cured.

The surface temperature of the areas to receive the concrete shall be 40° F or above when the concrete is placed. The contact surface to receive the magnesium phosphate concrete shall be dry. The contact surfaces to receive the modified high alumina concrete or portland cement based concrete may be damp but not saturated.

The construction joint between the paving notch extension and the existing abutment shall conform to the provisions for horizontal construction joints in Section 51-1.13, "Bonding," of the Standard Specifications. Concrete shall be placed in the spalled portions of the existing paving notch concurrently with the concrete for the paving notch extension.

Attention is directed to "Reinforcement" of these special provisions.

Structure excavation and backfill shall conform to the provisions in Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications, except for payment.

Drilling of holes and bonding of reinforcing steel dowels shall conform to the provisions for drilling and bonding dowels in Section 83-2.02D(1), "General," of the Standard Specifications. If reinforcement is encountered during drilling before the specified depth is attained, the Engineer shall be notified. Unless the Engineer approves coring through the reinforcement, the hole will be rejected and a new hole, in which reinforcement is not encountered, shall be drilled adjacent to the rejected hole to the depth shown on the plans.

The quantity of concrete for paving notch extension will be measured by the cubic foot.

The contract price paid per cubic foot for paving notch extension shall include full compensation for furnishing all labor, materials (including concrete for the paving notch spalled areas), tools, equipment, and incidentals, and for doing all the work involved in constructing the paving notch extension, complete in place, including structure excavation and backfill, reinforcement, and drilling and bonding dowels, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## **10-1.69 SOUND WALL**

### **DESCRIPTION**

This work shall consist of constructing sound walls of masonry block. Sound walls shall be supported on concrete barriers, retaining walls, footings, piles, pile caps, grade beams or posts as shown on the plans.

### **SOUND WALL (MASONRY BLOCK)**

Sound wall (masonry block), consisting of a reinforced hollow unit masonry block stem, shall be constructed in conformance with the provisions in Section 19, "Earthwork," Section 52, "Reinforcement," and Section 90, "Portland Cement Concrete," of the Standard Specifications and these special provisions.

Sound wall masonry unit stems shall be constructed with joints of mortar. Wall stems shall be constructed with hand laid block. Wall stems shall not be constructed with preassembled panels.

Except for concrete for pile caps at Retaining Wall 1271, concrete for sound wall footings, pile caps, and grade beams, if required, shall be minor concrete.

Concrete masonry units shall be hollow, load bearing, lightweight or medium weight class units conforming to the requirements in ASTM Designation: C 90. Standard or open-end units may be used. Open-end units, if used, shall not reduce the spacing of the bar reinforcement as shown on the plans.

The masonry units shall be nominal size and texture and of uniform color. The color shall be either gray or light tan, as shown on the plans, selected from the manufacturer's standards.

When high strength concrete masonry units with  $f'm=2500$  psi are shown on the plans, the high strength masonry units shall have a minimum compressive strength of 3750 psi based on net area. When high strength concrete masonry units with  $f'm=2000$  psi are shown on the plans, the high strength masonry units shall have a minimum compressive strength of 2800 psi based on net area. Each high strength concrete masonry unit shall be identified with a groove embedded in an interior corner. The groove shall extend from a mortar surface for a length of about 2 inches and shall have a depth of about 3/16 inch. When regular strength concrete masonry units with  $f'm=1500$  psi are shown on the plans, the regular strength masonry units shall have a minimum compressive strength of 1900 psi based on net area.

Expansion joint filler shall conform to the requirements in ASTM Designation: D 1751 or ASTM Designation: D 2000 M2AA 805.

Mortar shall be colored to match the units. Coloring shall be chemically inert, fade resistant mineral oxide or synthetic type.

Cementitious material for wall stems shall conform to the provisions in Section 90-2.01, "Cementitious Materials," of the Standard Specifications.

Hydrated lime shall conform to the requirements in ASTM Designation: C 207, Type S.

Mortar sand shall be commercial quality.

Mortar for laying masonry units shall consist, by volume, of one part cementitious material, zero to 0.5 part hydrated lime, and 2.25 to 3 parts mortar sand. Sufficient water shall be added to make a workable mortar. Each batch of mortar shall be accurately measured and thoroughly mixed. Mortar shall be freshly mixed as required. Mortar shall not be retempered more than one hour after mixing.

Prepackaged mortar materials and mortar containing admixtures may be used when approved in writing by the Engineer, provided the mortar shall not contain more than 0.05 percent soluble chlorides when tested in conformance with California Test 422 or more than 0.25 percent soluble sulfates, as  $SO_4$ , when tested in conformance with California Test 417.

Before laying masonry units using prepackaged mortar materials or mortar containing admixtures, the Contractor shall submit to the Engineer the proposed sources of the materials together with test data from an independent testing laboratory for mortar tested in conformance with California Test 551. The test data shall be from specimens having a moist cure, except that the sample shall not be immersed in lime water. The average 28-day compressive strength of the mortar shall be not less than 2500 psi.

Aggregate for grout used to fill masonry units shall consist of fine aggregate and coarse aggregate conforming to the provisions in Section 90-2.02, "Aggregates," of the Standard Specifications. At least 20 percent of the aggregate shall be coarse aggregate. The Contractor shall determine the grading except that 100 percent of the combined grading shall pass the 1/2-inch sieve.

At the option of the Contractor, grout for filling masonry units may be proportioned either by volume or weight. Grout shall contain only enough water to cause the grout to flow and fill the voids without segregation. The maximum amount of free water shall not exceed 0.7 times the weight of the cementitious material for regular strength masonry. The maximum amount of free water shall not exceed 0.6 times the weight of the cementitious material for high strength masonry.

Grout proportioned by volume for regular strength masonry shall consist of at least one part cementitious material and 4.5 parts aggregate. Grout proportioned by volume for high strength masonry shall consist of at least one part cementitious material and 3.5 parts aggregate. Aggregate volumes shall be based on a loose, air-dry condition.

Grout proportioned by weight for regular strength masonry shall contain not less than 550 pounds of cementitious material per cubic yard. Grout proportioned by weight for high strength masonry shall contain not less than 675 pounds of cementitious material per cubic yard.

Reinforced concrete masonry unit wall stems shall be constructed with mortar joints in conformance with the following:

- A. Concrete masonry unit construction shall be true and plumb in the lateral direction and shall conform to the grade shown on the plans in the longitudinal direction. Bond beam units or recesses for horizontal reinforcement shall be provided.
- B. Mortar joints shall be approximately 3/8 inch wide. Walls and cross webs forming cells to be filled with grout shall be full bedded in mortar to prevent leakage of grout. All head and bed joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells. Head joints shall be shoved tight.
- C. Mortared joints around cells to be filled shall be placed so as to preserve the unobstructed vertical continuity of the grout filling. Any overhanging mortar or other obstruction or debris shall be removed from the inside of such cells.
- D. Reinforcement shall be securely held in position at top and bottom with either wire ties or spacing devices and at intervals not exceeding 192 bar diameters before placing any grout. Wire shall be 16 gage or heavier. Wooden, aluminum, or plastic spacing devices shall not be used.
- E. Splices in vertical reinforcement shall be made only at the locations shown on the plans.

- F. Only those cells containing reinforcement shall be filled solidly with grout. All grout in the cells shall be consolidated at the time of placement by vibrating and reconsolidated after excess moisture has been absorbed but before plasticity is lost. Grout shall not be sliced with a trowel.
- G. Walls shall be constructed in 4-foot maximum height lifts. Grouting of each lift shall be completed before beginning masonry unit construction for the next lift. The top course of each lift shall consist of a bond beam.
- H. A construction joint shall be constructed at the top of the top course to permit placement of the mortar cap. The mix design for the mortar cap shall be as approved by the Engineer.
- I. Construction joints shall be made when the placing of grout, in grout filled cells, is stopped for more than one hour. The construction joint shall be approximately 1/2 inch below the top of the last course filled with grout.
- J. Bond beams shall be continuous. The top of unfilled cells under horizontal bond beams shall be covered with metal or plastic lath.
- K. When fresh masonry joins masonry that is partially or totally set, the contact surface shall be cleaned, roughened, and lightly wetted.
- L. Surfaces of concrete on which the masonry walls are to be constructed shall be roughened and cleaned, exposing the aggregate, and shall be flushed with water and allowed to dry to a surface dry condition immediately before laying the masonry units.
- M. Where cutting of masonry units is necessary, all cuts shall be made with a masonry saw to neat and true lines. Masonry units with cracking or chipping of the finished exposed surfaces will not be acceptable.
- N. Masonry shall be protected in the same manner specified for concrete structures in Section 90-8, "Protecting Concrete," of the Standard Specifications and these special provisions.
- O. During erection, all cells shall be kept dry in inclement weather by covering partially completed walls. The covering shall be waterproof fabric, plastic or paper sheeting, or other approved material. Wooden boards and planks shall not be used as covering materials. The covering shall extend down each side of masonry walls approximately 2 feet.
- P. Splashes, stains, or spots on the exposed faces of the wall shall be removed.

#### **MEASUREMENT AND PAYMENT**

Sound walls of the types designated in the Engineer's Estimate will be measured by the square foot of the area of wall projected on a vertical plane between the elevation lines shown on the plans and length of wall (including the exposed posts, backup wall for access openings, and access gates).

The contract price paid per square foot for sound wall of the types designated in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the sound wall, complete in place, including all anchorages and reinforcement, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer. Sound wall supports will be measured and paid for as separate items of work.

Sound wall grade beams will be measured and paid for as minor concrete (sound wall).

The contract price paid per cubic yard for minor concrete (sound wall) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the grade beams, complete in place, including excavation, backfill, and reinforcement, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **10-1.70 DRILL AND BOND DOWEL (CHEMICAL ADHESIVE)**

Drilling and bonding dowels with chemical adhesives shall conform to the details shown on the plans and these special provisions.

Reinforcing steel dowels shall conform to the provisions in "Reinforcement" of these special provisions.

Threaded rods used as dowels shall conform to the provisions in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications. The threaded rods shall be installed in conformance with the requirements for dowels specified herein.

Chemical adhesives to be used shall be selected from the Pre-Qualified Products List at:

[http://www.dot.ca.gov/hq/esc/approved\\_products\\_list/](http://www.dot.ca.gov/hq/esc/approved_products_list/)

The Contractor may propose to use a chemical adhesive not on the Pre-Qualified Products List. Information regarding product qualification can be obtained at the Transportation Laboratory.

The chemical adhesive system used shall be appropriate for the concrete temperature and installation conditions in conformance with the requirements in the Department's prequalified list.

Chemical adhesive systems shall be accompanied by a Certificate of Compliance as provided in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The certificate shall state that the material complies in all respects to the requirements of ICBO AC58 and Caltrans Augmentation/Revisions to ICBO AC58 available at the Transportation Laboratory and at:

[http://www.dot.ca.gov/hq/esc/approved\\_products\\_list/](http://www.dot.ca.gov/hq/esc/approved_products_list/)

At least 25 days prior to use, the Contractor shall submit one sample of each chemical adhesive system per lot to the Transportation Laboratory for testing. The sample shall consist of one unit of chemical adhesive, one mixing nozzle, and one retaining nut. A lot of chemical adhesives is defined as 100 units, or fraction thereof, of the same brand and product name.

Each chemical adhesive system shall be clearly and permanently marked with the manufacturer's name, model number of the system, manufacturing date, lot number, shelf life or expiration date, and current ICBO Evaluation Report (ER) number. Each carton of chemical adhesives shall contain the manufacturer's recommended installation procedures and warnings or precautions concerning the contents as may be required by State or Federal laws and regulations.

The holes shall be drilled by methods that will not shatter or damage the concrete adjacent to the holes. If reinforcement is encountered during drilling, before the specified depth is attained, the Engineer shall be notified. Unless the Engineer approves coring through the reinforcement, the hole will be rejected and a new hole, in which reinforcement is not encountered, shall be drilled adjacent to the rejected hole. The drilled holes shall be cleaned in conformance with the manufacturer's instructions and shall be dry at the time of placing the chemical adhesive. Unless otherwise specified, the diameter and depth of drilled holes shall conform to the values listed in the ICBO ER for the size of dowel or rod being installed.

Storage and installation procedures shall be as recommended by the manufacturer. A copy of the manufacturer's recommended installation procedure shall be provided to the Engineer at least 2 days prior to the start of work.

Immediately after inserting the dowels into the chemical adhesive, the dowels shall be supported as necessary to prevent movement during curing and shall remain undisturbed until the epoxy has cured a minimum time as specified in the Department's Pre-Qualified Products List. Dowels that are improperly bonded, as determined by the Engineer, will be rejected. Adjacent new holes shall be drilled, and new dowels shall be placed and securely bonded to the concrete. All work necessary to correct improperly bonded dowels shall be performed at the Contractor's expense.

Unless otherwise provided, dowels to be bonded into drilled holes will be measured and paid for as bar reinforcing steel (bridge).

Unless otherwise provided, drilling and bonding dowels with chemical adhesives will be measured and paid for by the unit as drill and bond dowel (chemical adhesive). The number of units to be paid for will be determined from actual count of the completed units in place.

The contract unit price paid for drill and bond dowel (chemical adhesive) shall include full compensation for furnishing all labor, materials (except dowels), tools, equipment, and incidentals, and for doing all the work involved in drilling the holes and bonding dowels with chemical adhesives, including coring through reinforcement when approved by the Engineer, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **10-1.71 DRILL AND BOND DOWELS**

Drilling and bonding dowels shall conform to the details shown on the plans, the provisions in Section 83-2.02D(1), "General," of the Standard Specifications, and these special provisions.

Dowels shall conform to the provisions for bar reinforcement in "Reinforcement" of these special provisions.

If reinforcement is encountered during drilling before the specified depth is attained, the Engineer shall be notified. Unless the Engineer approves coring through the reinforcement, the hole will be rejected and a new hole, in which reinforcement is not encountered, shall be drilled adjacent to the rejected hole to the depth shown on the plans.

Unless otherwise provided, dowels to be bonded into drilled holes will be paid for as bar reinforcing steel (bridge).

Unless otherwise provided, drilling and bonding dowels will be measured and paid for by the linear foot determined by the number and the required depth of holes as shown on the plans or as ordered by the Engineer.

The contract price paid per linear foot for drill and bond dowel shall include full compensation for furnishing all labor, materials (except reinforcing steel dowels), tools, equipment, and incidentals, and for doing all the work involved in drilling the holes, including coring through reinforcement when approved by the Engineer, and bonding the dowels, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

### **10-1.72 CORE CONCRETE**

Coring concrete shall consist of coring holes through reinforced concrete bridge members as shown on the plans and in conformance with these special provisions.

- A. Immediately after coring, the concrete cores shall be identified by the Contractor with a description of the core locations and submitted to the Engineer for inspection. When reinforcement is cut, coring operations shall be terminated, and the Contractor shall submit to the Engineer for approval, the procedure proposed to repair the cut reinforcement and to prevent further cutting of reinforcement.

The holes shall be cored by methods that will not shatter or damage the concrete adjacent to the holes.

Water for core drilling operations shall be from the local domestic water supply or shall not contain more than 1,000 parts per million of chlorides as Cl, nor more than 1,300 parts per million of sulfates as SO<sub>4</sub>, nor shall the water contain any impurities in a sufficient amount that would cause discoloration of the concrete or produce etching of the surface.

Water from core drilling operations shall not be permitted to fall on public traffic, to flow across shoulders or lanes occupied by public traffic, or to flow into gutters or other drainage facilities.

Coring concrete will be measured by the linear foot as core concrete of the sizes listed in the Engineer's Estimate. The cored concrete will be measured along the centerline of the hole without deduction for expansion joints.

The contract price paid per linear foot for core concrete of the sizes listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in coring the holes, including control of water from core drilling and repairing any damaged reinforcement, as shown on the plans, as specified in these special provisions, and as directed by the Engineer.

### **10-1.73 CORE AND PRESSURE GROUT DOWELS**

Coring and pressure grouting dowels shall include coring holes through reinforced concrete, placing dowels, and filling the holes with pressurized grout, as shown on the plans and in conformance with these special provisions.

Dowels to be placed in the cored holes shall conform to the provisions for bar reinforcement in "Reinforcement" of these special provisions.

Dowels to be pressure grouted in cored holes will be paid for as bar reinforcing steel (bridge).

Holes shall be cored by methods that will not shatter or damage the concrete adjacent to the holes.

Water for coring shall be from the local domestic water supply or shall not contain more than 1,000 parts per million of chlorides as Cl, nor more than 1,300 parts per million of sulfates as SO<sub>4</sub>, nor shall it contain any impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

Concrete areas and steel surfaces to be in contact with the grout shall be cleaned of all loose or foreign material that would in any way prevent bonding, and concrete holes shall be flushed with water and allowed to dry to a surface dry condition immediately before grouting.

Grout shall conform to the requirements of either ASTM Designation: C 1107 or ASTM Designation: C 845, Type K, and shall provide a minimum compressive strength of 5000 psi at 28 days when tested by California Test 551. The grout shall be mixed in accordance with the manufacturer's recommendations. Water shall conform to the provisions for water for prestressed concrete work in Section 90-2.03, "Water," of the Standard Specifications.

Admixtures shall not contain more than 500 parts per million of chlorides as Cl, when tested by California Test 422, and shall not contain more than 2500 parts per million of sulfates as SO<sub>4</sub>, when tested by California Test 417.

After dowel placement, the ends of the cored hole containing the dowel shall be sealed. A vent tube shall be placed at one end and one injection feed tube at the other end. The vent tube and injection feed tube shall be placed in the same end for cored holes that have only one end. The tubes shall be placed in the hole so that the air vents and the hole to be completely filled with grout. Sufficient pressure shall be used so that the hole is free of voids. Grout shall be pumped into the holes and continually wasted until air and water are ejected and there are no visible slugs.

Grout or water shall not flow into any waterway, on to public traffic, across shoulders or lanes occupied by public traffic, or into gutters or other drainage facilities.

Coring and pressure grouting dowels will be measured and paid for by the linear foot. The cored concrete will be measured along the centerline of the hole.

The contract price paid per linear foot for core and pressure grout dowels shall include full compensation for furnishing all labor, materials, except dowels, tools, equipment, and incidentals, and for doing all work involved in coring the holes, and pressure grouting the holes, including control of water from core drilling, as shown on the plans, as specified in these special provisions, and as directed by the Engineer.

**10-1.74 CLOSE ACCESS, DECK**

Close access, deck shall consist of placing temporary deck cover plates and making permanent concrete closures at deck slab access openings in conformance with the details shown on the plans and these special provisions.

Reinforcement shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications and these special provisions.

Deck cover plates and hardware shall conform to the provisions in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Deck cover plates shall remain the property of the Contractor.

Temporary deck cover plates shall be in place over access openings at all times when traffic lanes are not closed, and shall remain in place at each opening until the concrete overlay to permanently close that opening is to be placed.

Concrete for deck access closure shall be a high-strength material consisting of either magnesium phosphate concrete, modified high alumina based concrete, or portland cement based concrete. Magnesium phosphate concrete shall conform to the provisions for magnesium phosphate concrete in Section 83-2.02D(1), "General," of the Standard Specifications and these special provisions. Modified high alumina based concrete and portland cement based concrete shall be water activated and shall conform to the provisions for single component (water activated) magnesium phosphate concrete in Section 83-2.02D(1), "General," of the Standard Specifications and these special provisions.

A clean uniform aggregate filler may be used to extend the concrete. The moisture content of the aggregate shall not exceed 0.5 percent. Grading of the aggregate shall conform to the following:

Sieve Size	Percentage Passing
1/2"	100
No. 16	0-5

The amount of aggregate filler shall conform to the manufacturer's recommendation, but in no case shall the concrete strengths be less than that specified for magnesium phosphate concrete in Section 83-2.02D(1), "General," of the Standard Specifications.

Mixing of components of dual component (with a prepackaged liquid activator) magnesium phosphate concrete shall be by complete units, supplied by the manufacturer. Portions of units shall not be used. Water shall not be added to dual component magnesium phosphate concrete.

The areas to be filled with concrete shall be flushed with water to remove all dust and air blasted to remove all water before placing concrete.

Magnesium phosphate concrete shall not be mixed in containers or worked with tools containing zinc, cadmium, aluminum or copper. Modified high alumina based concrete shall not be mixed in containers or worked with tools containing aluminum.

Concrete shall not be retempered. Finishing tools that are cleaned with water shall be thoroughly dried before working the concrete.

When placing concrete on slopes exceeding 5 percent, the Engineer may require the Contractor to provide a flow controlled modified material.

Modified high alumina based concrete and portland cement based concrete shall be cured in conformance with the provisions in Section 90-7.01B, "Curing Compound Method," of the Standard Specifications. Magnesium phosphate concrete shall not be cured.

Unless otherwise permitted in writing by the Engineer, public traffic shall not be permitted on the new concrete until at least one hour after final set.

Closing each access opening in the deck will be measured and paid for by the unit as close access, deck.

The contract unit price paid for close access, deck shall include full compensation for furnishing all labor, materials (including concrete, reinforcement, deck cover plates, and hardware), tools, equipment, and incidentals, and for doing all the work involved in constructing access closures and temporary closures, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

**10-1.75 SEALING JOINTS**

Joints in concrete bridge decks and joints between concrete structures and concrete approach slabs must be sealed in conformance with the details shown on the plans, the provisions in Section 51, "Concrete Structures," of the Standard Specifications, and these special provisions.

When ordered by the Engineer, a joint seal larger than called for by the Movement Rating shown on the plans must be furnished and installed. Payment to the Contractor for furnishing the larger seal and for saw cutting the increment of additional depth of groove required will be determined as provided in Section 4-1.03, "Changes," of the Standard Specifications.

Saw cutting of grooves will not be required at existing joints that are to be sealed with Type A joint seal unless ordered by the Engineer. The Contractor must make saw cuts as ordered by the Engineer, and the saw cutting will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

**10-1.76 BONDED JOINT SEALS**

Bonded joint seals shall consist of a groove in the concrete that is filled with a preformed joint seal bonded to the joint openings with a suitable adhesive.

Joint openings in concrete bridge decks and joint openings between concrete structures and concrete approach slabs must be sealed in conformance with the details shown on the plans, the provisions for Type B joint seals in Section 51-1.12F(1), "Preparation for Type A and B Joint Seals," of the Standard Specifications and these special provisions.

Bonded joint seals shall be provided by one of the following manufacturers, or equal, complying with the Movement Ratings shown on the plans.

Bonded Joint Seal Systems	Address and Phone Number to Locate Nearest Distributor
Jeene® Seal System	Watson Bowman Acme Corporation 95 Pineview Drive Amherst, NY USA 14228 Phone: (800) 677-4922 Fax: (716) 691-9239 www.wbacorp.com
Silicoflex Joint Seal System	R.J. Watson, Inc. 78 John Glenn Drive Amherst, NY USA 14228 Phone: (716) 691-3301 Fax: (716) 691-3305 www.rjwatson.com
W-Seal Expansion Joint	D.S. TechStar, Inc. 1219 West Main Cross Street Findlay, Ohio USA 14228 Phone: (419) 424-0888 Fax: (419) 424-5959 www.techstar-inc.com

Jeene® Seal System shall consist of a groove in the concrete that is filled with a preformed neoprene elastomeric seal that is pressurized during the adhesion cure time and bonded to the joint openings with a specialty formulated epoxy adhesive.

Silicoflex Joint Seal System shall consist of a groove in the concrete that is filled with a preformed silicone joint seal, primed and bonded to the joint openings with a primer and a fast curing, silicone adhesive.

W-Seal Expansion Joints shall consist of a groove in the concrete that is filled with a preformed dual polymer thermoplastic seal and bonded to the joint openings with a single component adhesive.

The Contractor shall arrange for a manufacturer's field service representative to be on site for the first installation of each bonded joint seal system used. The qualified representative shall be present prior to and during the cleaning, preparing and the installation of the first bonded joint seal system and shall be available for advice during any remaining installations. The representative shall deliver manufacturer's instructions and specifications for the bonded joint seal system/s to be used in the work to the Engineer at the jobsite.

At the maximum joint closure, the top surface of the bonded joint seal shall be at least 3/4 of an inch below the deck surface.

Each shipment of bonded joint seals shall be accompanied by a Certificate of Compliance as provided in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications, except that said certificate shall state that the materials involved comply in all respects to the manufacturer's current published specifications for the product involved.

Grooves for the bonded joint seals shall conform to Section 51-1.12F(1), "Preparation for Type A and Type B Joint Seals," of the Standard Specifications. Grooves shall be cleaned and prepared in conformance with the manufacturer's instructions and shall be dry at the time of placing the primer and/or adhesive, and the bonded joint seal.

Field splices per joint may be made at locations and by methods approved by the Engineer. The seals are to be manufactured full length for the intended joint, then cut at the approved splice section and matched before splicing. The Contractor shall submit splicing details, prepared by the bonded joint seal manufacturer, to the Engineer for approval prior to beginning splicing work.

Joint surfaces shall be cleaned, prepared, primed (if required), the adhesive placed and the bonded joint seal placed in conformance with the manufacturer's recommendations. In case of a conflict between manufacturer's recommendations and these special provisions, the manufacturer's recommendations shall prevail.

When ordered by the engineer, a bonded joint seal larger than called for by the Movement Rating shown on the plans must be furnished and installed. Payment to the Contractor for furnishing the larger seal and for saw cutting the increment of additional depth of groove required will be determined as provided in Section 4-1.03, "Changes," of the Standard Specifications.

Bonded joint seals will be measured by the linear foot from end to end along the centerline of the completed seal including return sections at curb faces.

The contract price paid per linear foot for bonded joint seal of the Movement Rating listed in the contract items shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in constructing the bonded joint seals, including protecting, repairing, saw cutting, cleaning and preparing joint openings, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for the onsite and offsite services of the manufacturer's field service representative shall be considered as included in the contract price paid per linear foot for the bonded joint seal and no additional compensation will be allowed therefor.

### **10-1.77 REFINISHING BRIDGE DECKS**

Surfaces of bridge decks that are exposed when existing railings, curbs, or sidewalks are removed shall be prepared and refinished flush with the adjoining deck surface in conformance with these special provisions.

The Contractor may refinish the deck surface using Portland cement concrete or rapid setting concrete.

The exact area to be refinished will be designated by the Engineer.

When work is being performed within 10 feet of a traffic lane or performed over traffic, dust and residue from deck preparation and cleaning shall be removed or controlled by vacuum, water spray, or shield methods approved by the Engineer.

Concrete shall be removed without damage to concrete that is to remain in place. Damage to concrete that is to remain in place shall be repaired to a condition satisfactory to the Engineer.

The concrete in deck areas to be refinished shall be removed to a depth of approximately 3/4 inch below the adjoining deck surface. A 3/4 inch deep saw cut shall be made along the perimeter of deck areas to be refinished before removing the concrete.

Existing areas of the deck more than 3/4 inch below the adjoining deck surface shall be prepared by removing not less than 1/4 inch of surface material to expose sound aggregate.

Concrete removal may be done by abrasive blast cutting, abrasive sawing, impact tool cutting, machine rotary abrading, or by other methods, all to be approved by the Engineer. Cut areas shall be cleaned free of dust and all other loose and deleterious materials by brooming, abrasive blast cleaning, and high pressure air jets. Equipment shall be fitted with suitable traps, filters, drip pans, or other devices to prevent oil or other deleterious matter from being deposited on the deck.

Existing reinforcement, exposed during the removal of concrete, that is to remain in place shall be protected from damage.

Steel dowels shall be cut off 1 inch below the existing concrete deck surface or at the bottom of concrete removal, whichever is lower.

Where ref finishing is not required, steel dowels shall be cut off 1 inch below the finished surface and the holes shall be patched with rapid setting concrete.

Refinishing isolated high areas in the existing deck may be accomplished by cutting the concrete down to be flush with the plane of the adjoining deck surface by abrasive sawing, grinding, impact tool cutting, or by other methods approved by the Engineer. When grinding is performed to bring the deck concrete flush with the adjoining deck surface, the resulting surface shall have a coefficient of friction of not less than 0.35 as determined by California Test 342.

### **PORTLAND CEMENT CONCRETE**

An epoxy adhesive shall be applied to the surfaces to be refinished before placing the portland cement concrete. Immediately before applying the adhesive, the area to receive the adhesive shall be cleaned by abrasive blasting and blown clean by compressed air to remove dust and any other loose material. The area to be covered shall be surface dry and the substrate temperature shall be 40° F or above when the adhesive is applied.

The epoxy adhesive shall be furnished and applied in conformance with the provisions in Section 95-1, "General," and Section 95-2.03, "Epoxy Resin Adhesive for Bonding New Concrete to Old Concrete," of the Standard Specifications. The exact rate of applying epoxy adhesive will be determined by the Engineer. The adhesive shall be worked onto the surface with stiff brushes or equal.

Portland cement concrete used to fill the prepared areas shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications and the following:

- A. The concrete shall contain a minimum of 675 pounds of cementitious material per cubic yard.
- B. The amount of free water used in concrete shall not exceed 280 pounds per cubic yard.
- C. The aggregate shall contain between 50 and 55 percent fine aggregate and the remainder shall be pea gravel. The grading of pea gravel shall be such that 100 percent passes the 1/2 inch sieve and not more than 5 percent passes the No. 16 sieve, unless a larger size is ordered by the Engineer.
- D. Admixtures shall be furnished and used if directed by the Engineer.
- E. Immediately after depositing on the newly placed adhesive, the portland cement concrete shall be thoroughly consolidated until all voids are filled and free mortar appears on the surface and then struck off to the required grade.
- F. Concrete shall be cured as provided in Section 90-7.03, "Curing Structures," of the Standard Specifications.
- G. No loads of any kind shall be applied to the portland cement concrete for at least 7 days after placing.

**RAPID SETTING CONCRETE**

Rapid setting concrete used to fill the prepared areas shall be a high-strength material consisting of magnesium phosphate concrete, modified high alumina based concrete, or portland cement based concrete. Magnesium phosphate concrete shall conform to the requirements for magnesium phosphate concrete in Section 83-2.02D(1), "General," of the Standard Specifications. Modified high alumina based concrete and portland cement based concrete shall be water activated and shall conform to the requirements for single component (water activated) magnesium phosphate concrete in Section 83-2.02D(1), "General," of the Standard Specifications.

A clean uniform rounded aggregate filler may be used to extend the rapid setting concrete. The moisture content of the aggregate shall not exceed 0.5 percent. Grading of the aggregate shall conform to the following:

Sieve Size	Percentage Passing
1/2"	100
No. 16	0-5

The amount of aggregate filler shall conform to the manufacturer's recommendation, but in no case shall the concrete strengths be less than that specified for magnesium phosphate concrete in Section 83-2.02D(1), "General," of the Standard Specifications.

Mixing of components of dual component (with a prepackaged liquid activator) magnesium phosphate shall be by complete units, supplied by the manufacturer. Portions of units shall not be used. Water shall not be added to dual component magnesium phosphate.

Immediately before applying the rapid setting concrete, the surface shall be dry and blown clean by compressed air to remove accumulated dust and any other loose material. If the surface becomes contaminated at any time before placing the concrete, the surface shall be cleaned by abrasive blasting. The surface temperature of the areas to be covered shall be 39 F or above when the concrete is applied. Methods proposed to heat said surfaces are subject to approval by the Engineer. The surface for the magnesium phosphate concrete shall be dry. The surfaces for modified high alumina based concrete or portland cement based concrete may be damp but not saturated.

Magnesium phosphate concrete shall not be mixed in containers or worked with tools containing zinc, cadmium, aluminum, or copper. Modified high alumina based concrete shall not be mixed in containers or worked with tools containing aluminum.

Concrete shall not be retempered. Finishing tools that are cleaned with water shall be thoroughly dried before working the concrete.

When placing concrete on slopes exceeding 5 percent, the Engineer may require the Contractor to provide a flow controlled modified material.

Modified high alumina based concrete and portland cement based concrete shall be cured in conformance with the provisions in Section 90-7.01B, "Curing Compound Method," of the Standard Specifications. Magnesium phosphate concrete shall not be cured.

Unless otherwise permitted in writing by the Engineer, public traffic shall not be permitted on the new concrete until at least 24 hours after final set.

**FINISHING REQUIREMENTS**

In advance of the curing operations, the surface of the concrete shall be textured by brooming with a stiff bristled broom or by other suitable devices that will result in uniform scoring. Brooming shall be performed transversely. The operation shall be performed at a time and in a manner that produces a hardened surface having a uniform texture and a coefficient of friction of not less than 0.35 as determined by California Test 342.

Refinished surfaces that are found to have a coefficient of friction less than 0.35 shall be ground or grooved by the Contractor at his expense in conformance with the applicable provisions in Section 42, "Groove and Grind Pavement," of the Standard Specifications.

In the longitudinal direction, refinished surfaces shall not vary more than 0.02 foot from the lower edge of a 12-foot straightedge. The refinished surface shall be flush with the existing adjoining surface.

### **MEASUREMENT AND PAYMENT**

No adjustment of compensation will be made for any increase or decrease in the quantity of refinish bridge deck, regardless of the reason for the increase or decrease. The provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications shall not apply to the contract item of refinish bridge deck.

The quantity in square feet of refinish bridge deck to be paid for will be determined from the lengths and widths of the refinished areas, measured horizontally, plus 0.2 square foot for patching around each dowel.

The contract price paid per square foot for refinish bridge deck shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in refinishing areas of the existing bridge deck, including cutting steel dowels, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

## **10-1.78 POLYESTER CONCRETE OVERLAY**

### **GENERAL**

#### **Summary**

This work includes placing a polyester concrete overlay with a high molecular weight methacrylate (HMWM) resin prime coat to bridge decks.

#### **Submittals**

Submit an overlay placement plan and a public safety plan under Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The plan review time will be 15 days.

The overlay placement plan must include:

1. Schedule of overlay work and testing for each bridge
2. Description of equipment for applying HMWM resin
3. Description of equipment for measuring, mixing, placing, and finishing polyester concrete overlay
4. Method for isolating expansion joints
5. Cure time for polyester concrete
6. Description of equipment for applying sand
7. Storage and handling of HMWM resin and polyester concrete components
8. Disposal of excess HMWM resin, polyester concrete, and containers

The public safety plan must include details for:

1. A public notification letter with a list of delivery and posting addresses. The letter must state overlay work locations, dates, times, and what to expect. Deliver the letter to residences and businesses within 100 feet of overlay work and to local fire and police officials at least 7 days before starting work. Post the letter at the job site.
2. An airborne emissions monitoring plan prepared and executed by a certified industrial hygienist (CIH) certified in comprehensive practice by the American Board of Industrial Hygiene. The plan must have at least 4 monitoring points including the mixing point, application point, and point of nearest public contact. Monitor airborne emissions during overlay work and submit emissions monitoring results after completing the work.
3. An action plan for protection of the public when airborne emissions levels exceed permissible levels.
4. A copy of the CIH's certification.

Submit a material safety data sheet for each shipment of HMWM and polyester resin components before use.

#### **Quality Control and Assurance**

Submit samples of HMWM and polyester resins 15 days before use under Section 6-3, "Testing," of the Standard Specifications. Notify the Engineer 15 days before delivery of resin in containers over 55 gallons to the job site.

### **MATERIALS**

Polyester concrete consists of polyester resin binder and aggregate.

Polyester resin binder must:

1. Be an unsaturated isophthalic polyester-styrene co-polymer.
2. Contain at least 1 percent by weight gamma-methacryloxypropyltrimethoxysilane, an organosilane ester silane coupler.
3. Be used with a promoter compatible with suitable methyl ethyl ketone peroxide and cumene hydroperoxide initiators.
4. Comply with the following:

**Polyester Resin Binder**

Property	Requirement	Test Method
Viscosity *	75 to 200 cP (RVT, No. 1 Spindle, 20 RPM at 77°F)	ASTM D 2196
Specific Gravity *	1.05 to 1.10 at 77°F	ASTM D 1475
Elongation	35 percent, minimum Type I at 0.45 inch/min. Thickness = 0.25 ± 0.03 inch	ASTM D 638
	Sample Conditioning: 18/25/50 + 5/70	ASTM D 618
Tensile Strength	2500 psi, minimum Type I at 0.45 inch/min. Thickness = 0.25 ± 0.03 inch	ASTM D 638
	Sample Conditioning: 18/25/50 + 5/70	ASTM D 618
Styrene Content *	40 percent to 50 percent by weight	ASTM D 2369
PCC Saturated Surface-Dry Bond Strength	3.5 MPa, minimum, at 24 hours and 21° ± 1°C	California Test 551
Static Volatile Emission *	60 gram per square meter, loss, maximum	SCAQMD Method 309-91

\*Test must be performed before adding initiator.

Aggregate for polyester concrete must:

1. Comply with Section 90-2.02, "Aggregates," of the Standard Specifications
2. Have at most 45 percent crushed particles retained on the No. 8 sieve when tested under California Test 205
3. Have fine aggregate consisting of natural sand
4. Have a weighted average aggregate absorption of at most 1 percent when tested under California Tests 206 and 207
5. At the time of mixing with resin, have a moisture content of at most one half of the weighted average aggregate absorption when tested under California Test 226
6. Comply with one of the following aggregate gradings:

**Combined Aggregate Grading**

Sieve Size	Percentage Passing	
	3/8 inch Maximum	No. 4 Maximum
1/2 inch	100	100
3/8 inch	83 - 100	100
No. 4	65 - 82	62 - 85
No. 8	45 - 64	45 - 67
No. 16	27 - 48	29 - 50
No. 30	12 - 30	16 - 36
No. 50	6 - 17	5 - 20
No. 100	0 - 7	0 - 7
No. 200	0 - 3	0 - 3

HMWM resin prime coat consists of a resin, promoter, and initiator. HMWM resin must:

1. Be low odor and wax-free
2. Comply with the following:

**Methacrylate Resin**

Property	Requirement	Test Method
Volatile Content *	30 percent, maximum	ASTM D 2369
Viscosity *	25 cP, maximum, (Brookfield RVT with UL adaptor, 50 RPM at 77°F)	ASTM D 2196
Specific Gravity *	0.90 minimum, at 77°F	ASTM D 1475
Flash Point *	180°F, minimum	ASTM D 3278
Vapor Pressure *	1.0 mm Hg, maximum, at 77°F	ASTM D 323
PCC Saturated Surface-Dry Bond Strength	3.5 MPa, minimum at 24 hours and 21 ± 1°C	California Test 551

\* Test must be performed before adding initiator.

Sand for abrasive sand finish must:

1. Be commercial quality blast sand
2. Have at least 95 percent pass the No. 8 sieve and at least 95 percent retained on the No. 20 sieve when tested under California Test 205
3. Have an average absorption of at most 1 percent when tested under California Test 207

**CONSTRUCTION**

Use a continuous mixer to mix polyester concrete. The continuous mixer must:

1. Employ an auger screw/chute device.
2. Be equipped with an automatic metering device that measures and records aggregate and resin volumes. Record volumes at least every 5 minutes, including time and date. Submit recorded volumes at the end of the work shift.
3. Have a visible readout gage that displays volumes of aggregate and resin being recorded.
4. Be certified under California Test 109 before use.
5. Produce a satisfactory mix consistently during a demonstration.

Finishing equipment for polyester concrete must:

1. Have grade control capabilities
2. Be used to consolidate the polyester concrete

The Engineer will provide final grade and cross slope before the start of overlay work.

The Engineer may (1) test existing deck surfaces for smoothness under Section 51-1.17, "Finishing Bridge Decks," of the Standard Specifications, and (2) require the deck smoothness be modified under Section 42-2, "Grinding," of the Standard Specifications.

Prepare the deck under "Prepare Concrete Bridge Deck Surface," "Remove Unsound Concrete," and "Rapid Setting Concrete Patches" of these special provisions.

The deck must be dry before placing the HMWM prime coat. The concrete surface must be at least 50 degrees F and at most 100 degrees F. Relative humidity must be at most 85 percent.

Sweep the deck. Blow the deck clean with compressed air.

Thoroughly mix all components of HMWM resin prime coat. Apply the HMWM resin to the deck surface:

1. Within 5 minutes of mixing
2. At a rate of approximately 55 sq ft per gallon where concrete deck surface is removed; at a rate of approximately 90 sq ft per gallon at all other areas.
3. Uniformly and spread to completely cover surfaces to be overlaid

Place the HMWM prime coat on magnesium phosphate concrete no sooner than 72 hours after final set or on modified high alumina based concrete no sooner than 30 minutes after final set.

Place the polyester concrete:

1. Immediately after applying the HMWM prime coat
2. Before gelling
3. Within 15 minutes of adding initiator

The resin binder must weigh approximately 12 percent of the weight of the aggregate. The Engineer will determine the exact percentage. Polyester concrete must have an initial set time of at least 30 minutes and at most 120 minutes when tested using an initial-setting time Gillmore needle under ASTM C 266.

Consolidate and finish the overlay to the required grade and cross section using finishing equipment. Polyester concrete must be consolidated to a relative compaction of at least 97 percent when tested under California Test 552.

Apply a sand finish of at least 0.8 lbs per sq yd before gelling occurs.

Protect the overlay from moisture for at least 4 hours after finishing. Allow traffic or equipment on the overlay no sooner than 4 hours after final finishing.

Completed polyester concrete deck surfaces must comply with Section 51-1.17, "Finishing Bridge Decks," of the Standard Specifications.

Taper polyester concrete overlay edges if the overlay is not completed within the allowable lane closure time and is more than 1/2 inch higher in elevation than the adjacent pavement. Taper edges transverse to the direction of traffic at a 20:1 (horizontal:vertical) slope. Taper edges longitudinal to the direction of traffic at a 4:1 (horizontal:vertical) slope. Tapers may remain and be overlaid with polyester concrete overlay.

## **MEASUREMENT AND PAYMENT**

Furnish polyester concrete overlay will be measured and paid for by the cubic foot. The volume to be paid for will be determined based on the quantity of resin binder used, the percent by weight of resin binder in the polyester concrete, and a unit weight of 135 lb per cu ft. The payment quantity shall be the calculated quantity of polyester concrete overlay used in the work, except material used in trial overlays and wasted or unused material. When the plans show that unsound concrete patching material is polyester overlay, the payment quantity will include the patches.

Place polyester concrete overlay will be measured and paid for by the square foot. The area to be paid for will be based on the plan dimensions.

The contract price paid per cubic foot for furnish polyester concrete overlay shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing polyester concrete, including furnishing HMWM resin prime coat, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as ordered by the Engineer.

The contract price paid per square foot for place polyester concrete overlay shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the polyester concrete overlay, complete in place, including application of HMWM prime coat, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as ordered by the Engineer.

Public safety plan will be paid for on the basis of a lump sum price.

The contract lump sum price paid for public safety plan shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, including the public action plan and airborne emissions monitoring work performed by the CIH, notification of the public, and reporting test results, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Modifications to existing bridge deck smoothness will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

### **10-1.79 RAPID SETTING CONCRETE PATCHES**

This work shall consist of cleaning the surfaces and furnishing, placing, and finishing concrete patches. Concrete patches shall be placed in conformance with the details shown on the plans, the provisions of the Standard Specifications, and these special provisions.

The concrete material shall be a high-strength material consisting of either magnesium phosphate concrete, modified high alumina based concrete or portland cement based concrete. Magnesium phosphate concrete shall conform to the requirements for magnesium phosphate concrete in Section 83-2.02D(1), "General," of the Standard Specifications and these special provisions. Modified high alumina based concrete and portland cement based concrete shall be water activated and shall conform to the requirements for single component (water activated) magnesium phosphate concrete in Section 83-2.02D(1), "General," of the Standard Specifications and these special provisions.

A clean uniform rounded aggregate filler may be used to extend the concrete. The moisture content of the aggregate shall not exceed 0.5 percent. Grading of the aggregate shall conform to the following:

Sieve Size	Percentage Passing
1/2"	100
No. 16	0-5

The amount of aggregate filler shall conform to the manufacturer's recommendations, but in no case shall the concrete strengths be less than that specified for magnesium phosphate concrete in Section 83-2.02D(1), "General," of the Standard Specifications.

Mixing of components of dual component (with a prepackaged liquid activator) magnesium phosphate shall be by complete units, supplied by the manufacturer. Portions of units shall not be used. Water shall not be added to dual component magnesium phosphate.

Cleaning the contact surfaces of existing concrete shall be accomplished by abrasive blast cleaning the concrete and exposed reinforcing steel, as necessary, to remove all rust, paint, grease, asphalt or other foreign materials. A minimum of 1/8 inch of concrete shall be removed. Immediately prior to applying the new concrete, the surfaces shall be recleaned by sweeping and pressure jetting, or by other approved means, as necessary to remove debris which has accumulated during construction or after abrasive blast cleaning. The surface temperature of the areas to be covered shall be 39° F or above when the concrete is applied. Methods proposed to heat said surfaces are subject to approval by the Engineer. The contact surface for the magnesium phosphate concrete shall be dry. The contact surfaces for modified high alumina based concrete or portland cement based concrete may be damp but not saturated.

Magnesium phosphate concrete shall not be mixed in containers or worked with tools containing zinc, cadmium, aluminum or copper. Modified high alumina based concrete shall not be mixed in containers or worked with tools containing aluminum.

Concrete shall not be retempered. Finishing tools that are cleaned with water shall be thoroughly dried before working the concrete.

When placing concrete on slopes exceeding 5 percent, the Engineer may require the Contractor to provide a flow controlled modified material.

Modified high alumina based concrete and portland cement based concrete shall be cured in conformance with the provisions in Section 90-7.01B, "Curing Compound Method," of the Standard Specifications. Magnesium phosphate concrete shall not be cured.

Unless otherwise permitted in writing by the Engineer, public traffic shall not be permitted on the new concrete until at least one hour after final set.

Rapid setting concrete (patch) will be measured and paid for by the cubic foot.

The quantities of rapid setting concrete (patch), in cubic feet, to be paid for will be determined from the total number of pounds of concrete actually used in the patch divided by a plastic density of 135 pounds per cubic foot. Wasted or unused concrete will not be included. The number of pounds of concrete, with or without aggregate filler, will be determined from scale weights.

The contract price paid per cubic foot for rapid setting concrete (patch) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing concrete patches, including cleaning contact surfaces, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **10-1.80 ARCHITECTURAL SURFACE (TEXTURED CONCRETE)**

Architectural texture for concrete surfaces shall conform to the details shown on the plans, the provisions in Section 51, "Concrete Structures," of the Standard Specifications, and these special provisions.

Architectural textures listed below are required at concrete surfaces shown on the plans:

- A. Fractured rib texture
- B. Rib texture (vertical and diagonal)
- C. Heavy blast texture

The fractured rib texture shall be an architectural texture simulating the appearance of straight ribs of concrete with a fractured concrete texture imparted to the raised surface between the ribs. Grooves between ribs shall be continuous with no apparent curves or discontinuities. Variation of the groove from straightness shall not exceed 1/4 inch for each 10 feet of groove. The architectural texture shall have random shadow patterns. Broken concrete at adjoining ribs and groups of ribs shall have a random pattern. The architectural texture shall not have secondary patterns imparted by shadows or repetitive fractured surfaces.

The heavy abrasive blast texture shall be an architectural texture accomplished by abrasive blasting the surface of the concrete to produce a generally uniform color and sandy texture with air and water bubbles in the concrete partially exposed.

The rib texture (vertical and diagonal) shall be an architectural texture simulating the appearance of straight ribs of concrete with a fractured concrete or exposed aggregate texture imparted to the raised surface between the ribs. The ribs shall be either vertical or diagonal, as shown on the plans. Grooves between ribs shall be continuous with no apparent curves or discontinuities. Variation of the groove from straightness shall not exceed 1/4 inch for each 10 feet of groove. The architectural texture shall have random shadow patterns. Broken concrete at adjoining ribs and groups of ribs shall have a random pattern. The architectural texture shall not have secondary patterns imparted by shadows or repetitive fractured surfaces.

### TEST PANEL

A test panel at least 4' x 4' in size shall be successfully completed at a location approved by the Engineer before beginning work on architectural textures. The test panel shall be constructed and finished with the materials, tools, equipment, and methods to be used in constructing the architectural texture. If ordered by the Engineer, additional test panels shall be constructed and finished until the specified finish, texture, and color are obtained, as determined by the Engineer.

The test panel approved by the Engineer shall be used as the standard of comparison in determining acceptability of architectural texture for concrete-surfaces.

### FORM LINERS

Form liners shall be used for textured concrete surfaces and shall be installed in conformance with the manufacturer's recommendations, unless other methods of forming textured concrete surfaces are approved by the Engineer. Form liners shall be manufactured from an elastomeric material or a semi-elastomeric polyurethane material by a manufacturer of commercially available concrete form liners. No substitution of other types of formliner material will be allowed. Form liners shall leave crisp, sharp definition of the architectural surface. Recurring textural configurations exhibited by repeating, recognizable shadow patterns shall be prevented by proper casting of form liner patterns. Textured concrete surfaces with such recurring textural configurations shall be reworked to remove such patterns as approved by the Engineer or the concrete shall be replaced.

Form liners shall have the following properties:

Description	ASTM Designation:	Range
Elastomeric material		
Shore A hardness	D 2240	20 to 65
Tensile strength (psi)	D 412	130 to 900
Semi-elastomeric polyurethane		
Shore D hardness	D 2240	55 to 65
Tensile strength (psi)	D 2370	2600 minimum

Cuts and tears in form liners shall be sealed and repaired in conformance with the manufacturer's recommendations. Form liners that are delaminated from the form shall not be used. Form liners with deformations to the manufactured surface caused by improper storage practices or any other reason shall not be used.

Form liners shall extend the full length of texturing with transverse joints at 8 foot minimum spacing. Small pieces of form liners shall not be used. Grooves shall be aligned straight and true. Grooves shall match at joints between form liners. Joints in the direction of grooves in grooved patterns shall be located only in the depressed portion of the textured concrete. Adjoining liners shall be butted together without distortion, open cracks, or offsets at the joints. Joints between liners shall be cleaned before each use to remove any mortar in the joint.

Adhesives shall be compatible with the form liner material and with concrete. Adhesives shall be approved by the liner manufacturer. Adhesives shall not cause swelling of the liner material.

## **RELEASING FORM LINERS**

Products and application procedures for form release agents shall be approved by the form liner manufacturer. Release agents shall not cause swelling of the liner material or delamination from the forms. Release agents shall not stain the concrete or react with the liner material. For reliefs simulating fractured concrete or wood grain surfaces the application method shall include the scrubbing method using a natural bristle scrub brush in the direction of grooves or grain. The release agent shall coat the liner with a thin film. Following application of form release agent, the liner surfaces shall be cleaned of excess amounts of agent using compressed air. Buildup of form release agent caused by the reuse of a liner shall be removed at least every 5 uses.

Form liners shall release without leaving particles or pieces of liner material on the concrete and without pulling or breaking concrete from the textured surface. The concrete surfaces exposed by removing forms shall be protected from damage.

## **ABRASIVE BLASTING**

The architectural texture shall be abrasive blasted with fine abrasive to remove the sheen without exposing coarse aggregate.

## **CURING**

Concrete surfaces with architectural texture shall be cured only by the forms-in-place or water methods. Seals and curing compounds shall not be used.

## **MEASUREMENT AND PAYMENT**

Rib texture (vertical and diagonal) will be measured and paid for by the square foot.

Fracture rib texture on Retaining Wall 1271 will be measured and paid for by the square foot.

The contract price paid per square foot for fracture rib texture on Retaining Wall 1271 and for rib texture (vertical and diagonal) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in architectural texture, complete in place, including test panels, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for fractured rib and architectural surface (textured concrete) texture on concrete barriers shall be considered as included in the contract price paid per linear foot for concrete barriers with the architectural surface (textured concrete), and no separate payment will be made therefor.

## **10-1.81 REINFORCEMENT**

Reinforcement shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications and these special provisions.

The provisions in "Welding Quality Control" of these special provisions do not apply to resistance butt welding.

When joining new reinforcing bars to existing reinforcement, sample splices shall be made using only the deformation pattern of the new reinforcement to be spliced.

The following shall apply to ultimate splices for bar reinforcing cages of columns and cast-in-place piles where the longitudinal bars are spliced vertically at the job site in or above their final positions:

1. Instead of being removed from the completed lot, sample splices may be prepared in the same manner as specified in Section 52-1.08C(2)(a), "Production Test Requirements for Service Splices," of the Standard Specifications for service sample splices. These sample splices shall be tested in conformance with the requirements in Section 52-1.08C(3), "Ultimate Butt Splice Test Criteria," of the Standard Specifications.
2. Splices may be encased in concrete prior to having the QCM review, approve, and forward each Production Test Report to the Engineer. Should the Contractor exercise this option, it is expressly understood that the Contractor will not be relieved of the Contractor's responsibility for incorporating material in the work that conforms to the requirements of the plans and specifications. Material not conforming to these requirements will be subject to rejection.

For bar reinforcing cages measuring 4 feet in diameter and larger:

1. At least 4 vertical bars of each cage, equally spaced around the circumference, shall be tied at all reinforcement intersections with double wire ties.
2. At least 25 percent of remaining reinforcement intersections in each cage shall be tied with single wire ties. Tied intersections shall be staggered from adjacent ties.
3. Bracing shall be provided to avoid collapse of the cage during assembly, transportation, and installation.

Successful completion of these minimum baseline requirements for reinforcement cages 4 feet in diameter and larger will in no way relieve the Contractor of full responsibility for engineering the temporary support and bracing of the cages during construction.

Reinforcement shown on the plans to be galvanized shall be galvanized in conformance with the requirements in ASTM Designation: A 767/A 767M, Class 1, except that chromating will not be required.

Within areas where galvanized reinforcement is required, tie wire and bar chairs or other metallic devices used to secure or support the reinforcement shall be galvanized, plastic coated, or epoxy coated to prevent corrosion of the devices or damage to the galvanized reinforcement.

Galvanized surfaces that are abraded or damaged caused by shipping, handling, or installation shall be repaired as specified in Section 75-1.05, "Galvanizing," of the Standard Specifications.

## **MEASUREMENT AND PAYMENT**

Measurement and payment for reinforcement in structures shall conform to the provisions in Section 52-1.10, "Measurement," and Section 52-1.11, "Payment," of the Standard Specifications and these special provisions.

Full compensation for galvanizing steel reinforcement shall be considered as included in the prices paid for the various items of work involved and no additional compensation will be allowed therefor.

### **10-1.82 HEADED BAR REINFORCEMENT**

#### **GENERAL**

##### **Summary**

This section includes specifications for fabricating and placing bar reinforcement with heads attached to one or both ends. Unless otherwise shown, use only headed bar reinforcement with heads having a net area of at least 9 times the area of the reinforcing bar (designated as "Full Size" on the Department's Prequalified Products List).

##### **Definitions:**

**affected zone:** Part of a reinforcing bar where a property, including a physical, metallurgical, or material characteristic, of the bar has been changed by the manufacturing process for headed bar reinforcement.

**lot:** One hundred fifty, or fraction thereof, of headed bar reinforcement of the same bar size with heads of the same size and type and manufactured by the same method and produced from bar material of a single heat number and head material of a single heat number. A reinforcing bar that has a head on each end is counted as 2 reinforcing bars for establishing and testing production lots.

**visible necking:** A visible decrease in the sample's cross sectional area at the point of fracture.

##### **Submittals**

Submit a certificate of compliance for each shipment of headed bar reinforcement delivered to the job site. Include with the submittal:

1. Copy of the mill test report
2. Specified production test reports
3. Daily production logs

A production test report for all testing performed on each lot must be prepared by the laboratory performing the testing and submitted for review and approval. The report must be signed by an engineer who represents the laboratory and is registered as a civil engineer in the State. For each set of samples, the report must include:

1. Contract number
2. Bridge number
3. Lot number
4. Bar size
5. Type of headed bar reinforcement
6. Physical condition of test sample
7. Notable defects
8. Affected-zone limits
9. Location of visible necking area
10. Ultimate strength of each headed bar

## **Quality Control and Assurance**

### **General**

The provisions of "Welding Quality Control" do not apply to headed bar reinforcement.

Inspect and test before, during, and after manufacturing headed bar reinforcement to ensure materials and workmanship comply with the specifications.

The manufacturer must maintain a daily production log for the manufacture of headed bar reinforcement for each production lot. The log must show:

1. Production lot numbers
2. Heats of bar material and head material used in the manufacture of each production lot
3. Number of bars in each production lot
4. Manufacturing records, including tracking and production parameters for welds or forgings.

### **Production Tests**

Perform production tests on headed bar reinforcement samples at a laboratory on the Department's Pre-Qualified Products List that has:

1. Tensile testing machine capable of breaking the largest size of reinforcing bar to be tested
2. Operators who have received formal training for performing the testing in ASTM A 970/A 970M
3. Record of annual calibration of testing equipment performed by an independent third party that has:
  - 3.1. Standards traceable to NIST
  - 3.2. Formal reporting procedure, including published test forms

Notify the Engineer when any lots of headed bar reinforcement are ready for testing. Include in the notification:

1. Number of lots to be tested
2. Location where the tests will be conducted

After being notified, the Engineer randomly selects 4 test samples from each production lot of headed bar reinforcement that is ready for shipment to the job site. Test samples are 4 feet long for bar reinforcement sizes #9 and below, and 6 feet long for bar reinforcement sizes #10 and above. Test samples of epoxy-coated headed bar reinforcement are taken after the reinforcement has been prepared for epoxy coating.

Before shipping to the laboratory, securely bundle the 4 samples for each production test and identify with a completed sample identification card furnished by the Engineer. Do not perform production tests on samples from bundles containing fewer than 4 samples.

Tensile test 3 samples from each production lot. Conduct 1 tensile test on each sample.

Tensile tests must comply with ASTM A 970/ A970M, Class A, except at rupture, visible necking in the reinforcing bar must exist at a distance of at least 1 bar diameter away from the affected zone.

If 1 of the test samples fails to comply with the requirements, perform 1 test on the additional sample. If the additional test sample or any of the other original test samples fails to comply with these requirements, the Department rejects all headed bar reinforcement represented by the tests.

Tag each unit of headed bar reinforcement in a production lot to be shipped to the job site in a way that allows accurate identification at the job site. The Department rejects unidentified headed bar reinforcement received at the job site.

### **MATERIALS**

The type of headed bar reinforcement must be on the Department's Prequalified Products List.

Welding, welder qualifications, and inspection of welding must comply with the specifications for friction welding in AWS C6.1.

Equipment used to perform friction welding must be fitted with an in-process monitoring system to record essential production parameters that describe the process of welding the head onto the reinforcement. The parameters to be recorded include:

1. Friction welding force
2. Forge force
3. Rotational speed
4. Friction upset distance and time
5. Forge upset distance and time

## **MEASUREMENT AND PAYMENT**

Quantities of headed bar reinforcement are measured as units determined from the number of heads shown on the plans or as directed by the Engineer.

The contract unit price paid for headed bar reinforcement includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing headed bar reinforcement, including conforming to all testing requirements, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Bar reinforcement to be used in the manufacture of headed bar reinforcement and placing the completed headed bar reinforcement into the work is measured and paid for as specified in Section 52, "Reinforcement," of the Standard Specifications, except that the lengths to be used in the computation of calculated weight of bar reinforcement is the entire length of the completed headed

### **10-1.83 BRIDGE DECK METHACRYLATE RESIN TREATMENT**

#### **GENERAL**

##### **Summary**

This work includes applying a high molecular weight methacrylate (HMWM) resin system with sand and absorbent material to bridge decks.

##### **Submittals**

Submit a HMWM resin system placement plan and a public safety plan under Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The plan review time is 15 days.

The HMWM resin system placement plan must include:

1. Schedule of work and testing for each bridge
2. Description of equipment for applying HMWM resin
3. Range of gel time and final cure time for HMWM resin
4. Absorbent material to be used
5. Description of equipment for applying and removing excess sand and absorbent material
6. Procedure for removing HMWM resin from the deck, including equipment
7. Storage and handling of HMWM resin components and absorbent material
8. Disposal of excess HMWM resin and containers

The public safety plan must include:

1. A public notification letter with a list of delivery and posting addresses. The letter must state HMWM resin work locations, dates, times, and what to expect. Deliver the letter to residences and businesses within 100 feet of HMWM resin work locations and to local fire and police officials at least 7 days before starting work. Post the letter at the job site.
2. An airborne emissions monitoring plan prepared and executed by a certified industrial hygienist (CIH) certified in comprehensive practice by the American Board of Industrial Hygiene. The plan must have at least 4 monitoring points including the mixing point, application point, and point of nearest public contact. Monitor airborne emissions during HMWM resin work and submit emissions monitoring results after completing the work.
3. An action plan for protection of the public when airborne emissions levels exceed permissible levels.
4. A copy of the CIH's certification.

Submit a material safety data sheet for each HMWM resin system component and diatomaceous earth shipment before use.

##### **Quality Control and Assurance**

Submit samples of HMWM resin components 15 days before use under Section 6-3, "Testing," of the Standard Specifications. Notify the Engineer 15 days before delivery of HMWM resin components in containers over 55 gallons to the job site.

Complete a test area before starting work. Results from airborne emissions monitoring of the test area must be submitted to the Engineer before starting production work.

The test area must:

1. Be approximately 500 sq ft
2. Be placed within the project limits outside the traveled way at an approved location
3. Be constructed using the same equipment as the production work
4. Replicate field conditions for the production work
5. Demonstrate proposed means and methods meet the acceptance criteria
6. Demonstrate production work will be completed within the time allowed
7. Demonstrate suitability of the airborne emissions monitoring plan

The test area will be acceptable if:

1. The treated deck surface is tack free and non-oily
2. The sand cover adheres and resists brushing by hand
3. Excess sand and absorbent material has been removed
4. The coefficient of friction is at least 0.35 when tested under California Test 342

### MATERIALS

HMWM resin system consists of a resin, promoter, and initiator. HMWM resin must be low odor and comply with the following:

<b>HMWM Resin</b>		
Property	Requirement	Test Method
Volatile Content*	30 percent, maximum	ASTM D 2369
Viscosity*	25 cP, maximum, (Brookfield RVT with UL adaptor, 50 RPM at 77°F)	ASTM D 2196
Specific Gravity*	0.90 minimum, at 77°F	ASTM D 1475
Flash Point*	180°F, minimum	ASTM D 3278
Vapor Pressure*	1.0 mm Hg, maximum, at 77°F	ASTM D 323
Tack-free Time	400 minutes, maximum, at 25°C	Specimens prepared per California Test 551
PCC Saturated Surface-Dry Bond Strength	3.5 MPa, minimum at 24 hours and 21 ± 1°C	California Test 551

\*Test must be performed before adding initiator.

Sand for abrasive sand finish must:

1. Be commercial quality dry blast sand
2. Have at least 95 percent pass the No. 8 sieve and at least 95 percent retained on the No. 20 sieve when tested under California Test 205

Absorbent material must be diatomaceous earth, abrasive blast dust, or substitute recommended by the HMWM resin supplier and approved by the Engineer.

### CONSTRUCTION

HMWM resin system applied by machine must be:

1. Combined in volumetric streams of promoted resin to initiated resin by static in-line mixers
2. Applied without atomization

HMWM resin system may be applied manually. Limit the quantity of resin mixed for manual application to 5 gallons at a time.

Prepare the deck under "Clean Bridge Decks," "Remove Unsound Concrete," and "Rapid Setting Concrete Patches" of these special provisions.

The deck must be dry before applying HMWM resin. The concrete surface must be at least 50 degrees F and at most 100 degrees F. Relative humidity must be expected to be at most 85 percent during the work shift.

Thoroughly mix all components of HMWM resin. Apply HMWM resin to the deck surface within 5 minutes of mixing at approximately 90 sq ft per gallon. The Engineer determines the exact application rate. The resin gel time must be between 40 and 90 minutes. HMWM resin that thickens during application is rejected.

Spread the HMWM resin uniformly. Completely cover surfaces to be treated and fill all cracks. Redistribute excess resin using squeegees or brooms within 10 minutes of application. For textured or grooved deck surfaces, excess resin must be removed from the texture indentations.

Apply the abrasive sand finish of at least 2 lbs per sq yd or until saturation as determined by the Engineer no sooner than 20 minutes after applying resin. Apply absorbent material before opening lane to traffic. Remove excess sand and absorbent material by vacuuming or power sweeping.

Traffic or equipment will be allowed on the overlay after the Engineer has determined:

1. The treated deck surface is tack free and non-oily
2. The sand cover adheres and resists brushing by hand
3. Excess sand and absorbent material has been removed
4. No material will be tracked beyond limits of treatment by traffic

Remove the HMWM resin from the deck surface if the Engineer determines (1) the above listed conditions have not been met and (2) the allowable lane closure time will be exceeded.

The Engineer performs California Test 342 on treated deck surfaces. The Engineer provides at least a 15-day notice for the Contractor to provide traffic control for each bridge location. The coefficient of friction of the treated deck must be at least 0.35.

#### **MEASUREMENT AND PAYMENT**

Bridge deck methacrylate resin treatment will be measured by the square foot based on the dimensions shown on the plans and will be paid for as treat bridge deck. Furnish bridge deck treatment material will be measured by the gallon of mixed HMWM resin actually placed and will be paid for as furnish bridge deck treatment material. No payment will be made for materials wasted or not incorporated in the work.

The contract price paid per square foot for treat bridge deck shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in preparing and applying bridge deck HMWM resin treatment, including sand and absorbent material, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract price paid per gallon for furnish bridge deck treatment material shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals necessary to furnish the bridge deck treatment material to the site of the work ready for application, as specified in the Standard Specifications and these special provisions and as directed by the Engineer.

Public safety plan will be paid for on the basis of a lump sum price.

The contract lump sum price paid for public safety plan shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, including the public action plan and airborne emissions monitoring work performed by the CIH, notification of the public, and reporting test results, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for providing traffic control for the Engineer to perform inspections and testing shall be considered as included in the contract prices paid for the items of work involving bridge deck methacrylate resin treatment and no additional compensation will be allowed therefor.

#### **10-1.84 STEEL STRUCTURES**

Construction of steel structures shall conform to the provisions in Section 55, "Steel Structures," of the Standard Specifications and these special provisions.

##### **GENERAL**

Pressure grouting of high strength threaded rods shall conform to the provisions in "Core and Pressure Grout Dowels" of these special provisions.

Full compensation for pressure grouting of high strength threaded rods is included in the contract price paid per pound for erect structural steel (bridge) and no separate payment will be made therefor.

Attention is directed to "Welding" in Section 8, "Materials," of these special provisions.

## MATERIALS

High-strength fastener assemblies and other bolts attached to structural steel with nuts and washers shall be zinc coated. When direct tension indicators are used in these assemblies, the direct tension indicator and all components of the fastener assembly shall be zinc coated by the mechanical deposition process.

### ROTATIONAL CAPACITY TESTING PRIOR TO SHIPMENT TO JOB SITE

Rotational capacity tests shall be performed on all lots of high-strength fastener assemblies prior to shipment of these lots to the project site. Zinc-coated assemblies shall be tested after all fabrication, coating, and lubrication of components has been completed. One hardened washer shall be used under each nut for the tests.

The requirements of this section do not apply to high-strength cap screws or high-strength bolts used for slip base plates.

Each combination of bolt production lot, nut lot, and washer lot shall be tested as an assembly.

A rotational capacity lot number shall be assigned to each combination of lots tested. Each shipping unit of fastener assemblies shall be plainly marked with the rotational capacity lot number.

Two fastener assemblies from each rotational capacity lot shall be tested.

The following equipment, procedure, and acceptance criteria shall be used to perform rotational capacity tests on and determine acceptance of long bolts. Fasteners are considered to be long bolts when full nut thread engagement can be achieved when installed in a bolt tension measuring device:

#### A. Long Bolt Test Equipment:

1. Calibrated bolt tension measuring device with adequate tension capacity for the bolts being tested.
2. Calibrated dial or digital torque wrench. Other suitable tools will be required for performing Steps 7 and 8 of the Long Bolt Test Procedure. A torque multiplier may be required for large diameter bolts.
3. Spacer washers or bushings. When spacer washers or bushings are required, they shall have the same inside diameter and equal or larger outside diameter as the appropriate hardened washers conforming to the requirements in ASTM Designation: F 436.
4. Steel beam or member, such as a girder flange or cross frame, to which the bolt tension measuring device will be attached. The device shall be accessible from the ground.

#### B Long Bolt Test Procedure:

1. Measure the bolt length. The bolt length is defined as the distance from the end of the threaded portion of the shank to the underside of the bolt head.
2. Install the nut on the bolt so that 3 to 5 full threads of the bolt are located between the bearing face of the nut and the underside of the bolt head. Measure and record the thread stickout of the bolt. Thread stickout is determined by measuring the distance from the outer face of the nut to the end of the threaded portion of the shank.
3. Insert the bolt into the bolt tension measuring device and install the required number of washers, and additional spacers as needed, directly beneath the nut to produce the thread stickout measured in Step 2 of this procedure.
4. Tighten the nut using a hand wrench to a snug-tight condition. The snug tension shall not be less than the Table A value but may exceed the Table A value by a maximum of 2 kips.

Table A

High-Strength Fastener Assembly Tension Values to Approximate Snug-Tight Condition	
Bolt Diameter (inches)	Snug Tension (kips)
1/2	1
5/8	2
3/4	3
7/8	4
1	5
1-1/8	6
1-1/4	7
1-3/8	9
1-1/2	10

5. Match-mark the assembly by placing a heavy reference start line on the face plate of the bolt tension measuring device which aligns with (1) a mark placed on one corner of the nut and (2) a radial line placed across the flat on the end of the bolt or on the exposed portions of the threads of tension control bolts. Place an additional mark on the outside of the socket that overlays the mark on the nut corner such that this mark will be visible while turning the nut. Make an additional mark on the face plate, either 2/3 of a turn, one turn, or 1-1/3 turn clockwise from the heavy reference start line, depending on the bolt length being tested as shown in Table B.

Table B

Required Nut Rotation for Rotational Capacity Tests <sup>(a)(b)</sup>	
Bolt Length (measured in Step 1)	Required Rotation (turn)
4 bolt diameters or less	2/3
Greater than 4 bolt diameters but no more than 8 bolt diameters	1
Greater than 8 bolt diameters, but no more than 12 bolt diameters <sup>(c)</sup>	1-1/3

(a) Nut rotation is relative to bolt, regardless of the element (nut or bolt) being turned. For bolts installed by 1/2 turn and less, the tolerance shall be plus or minus 30 degrees; for bolts installed by 2/3 turn and more, the tolerance shall be plus or minus 45 degrees.

(b) Applicable only to connections in which all material within grip of the bolt is steel.

(c) When bolt length exceeds 12 diameters, the required rotation shall be determined by actual tests in a suitable tension device simulating the actual conditions.

6. Turn the nut to achieve the applicable minimum bolt tension value listed in Table C. After reaching this tension, record the moving torque, in foot-pounds, required to turn the nut, and also record the corresponding bolt tension value in pounds. Torque shall be measured with the nut in motion. Calculate the value, T, where  $T = [(the\ measured\ tension\ in\ pounds) \times (the\ bolt\ diameter\ in\ inches) / 48]$ .

Table C

Minimum Tension Values for High-Strength Fastener Assemblies	
Bolt Diameter (inches)	Minimum Tension (kips)
1/2	12
5/8	19
3/4	28
7/8	39
1	51
1-1/8	56
1-1/4	71
1-3/8	85
1-1/2	103

7. Turn the nut further to increase bolt tension until the rotation listed in Table B is reached. The rotation is measured from the heavy reference line made on the face plate after the bolt was snug-tight. Record this bolt tension.
8. Loosen and remove the nut and examine the threads on both the nut and bolt.

C. Long Bolt Acceptance Criteria:

1. An assembly shall pass the following requirements to be acceptable: (1) the measured moving torque (Step 6) shall be less than or equal to the calculated value, T (Step 6), (2) the bolt tension measured in Step 7 shall be greater than or equal to the applicable turn test tension value listed in Table D, (3) the nut shall be able to be removed from the bolt without signs of thread stripping or galling after the required rotation in Step 7 has been achieved, (4) the bolt does not shear from torsion or fail during the test, and (5) the assembly does not seize before the final rotation in Step 7 is reached. Elongation of the bolt in the threaded region between the bearing face of the nut and the underside of the bolt head is expected and will not be considered a failure. Both fastener assemblies tested from one rotational capacity lot shall pass for the rotational capacity lot to be acceptable.

Table D

Turn Test Tension Values	
Bolt Diameter (inches)	Turn Test Tension (kips)
1/2	14
5/8	22
3/4	32
7/8	45
1	59
1-1/8	64
1-1/4	82
1-3/8	98
1-1/2	118

The following equipment, procedure, and acceptance criteria shall be used to perform rotational capacity tests on and determine acceptance of short bolts. Fasteners are considered to be short bolts when full nut thread engagement cannot be achieved when installed in a bolt tension measuring device:

A. Short Bolt Test Equipment:

1. Calibrated dial or digital torque wrench. Other suitable tools will be required for performing Steps 7 and 8 of the Short Bolt Test Procedure. A torque multiplier may be required for large diameter bolts.
2. Spud wrench or equivalent.
3. Spacer washers or bushings. When spacer washers or bushings are required, they shall have the same inside diameter and equal or larger outside diameter as the appropriate hardened washers conforming to the requirements in ASTM Designation: F 436.
4. Steel plate or girder with a hole to install bolt. The hole size shall be 1/16 inch greater than the nominal diameter of the bolt to be tested. The grip length, including any plates, washers, and additional spacers as needed, shall provide the proper number of threads within the grip, as required in Step 2 of the Short Bolt Test Procedure.

B. Short Bolt Test Procedure:

1. Measure the bolt length. The bolt length is defined as the distance from the end of the threaded portion of the shank to the underside of the bolt head.
2. Install the nut on the bolt so that 3 to 5 full threads of the bolt are located between the bearing face of the nut and the underside of the bolt head. Measure and record the thread stickout of the bolt. Thread stickout is determined by measuring the distance from the outer face of the nut to the end of the threaded portion of the shank.
3. Install the bolt into a hole on the plate or girder and install the required number of washers and additional spacers as needed between the bearing face of the nut and the underside of the bolt head to produce the thread stickout measured in Step 2 of this procedure.
4. Tighten the nut using a hand wrench to a snug-tight condition. The snug condition shall be the full manual effort applied to the end of a 12-inch long wrench. This applied torque shall not exceed 20 percent of the maximum allowable torque in Table E.

Table E

Maximum Allowable Torque for High-Strength Fastener Assemblies	
Bolt Diameter (inches)	Torque (ft-lb)
1/2	145
5/8	285
3/4	500
7/8	820
1	1220
1-1/8	1500
1-1/4	2130
1-3/8	2800
1-1/2	3700

5. Match-mark the assembly by placing a heavy reference start line on the steel plate or girder which aligns with (1) a mark placed on one corner of the nut and (2) a radial line placed across the flat on the end of the bolt or on the exposed portions of the threads of tension control bolts. Place an additional mark on the outside of the socket that overlays the mark on the nut corner such that this mark will be visible while turning the nut. Make 2 additional small marks on the steel plate or girder, one 1/3 of a turn and one 2/3 of a turn clockwise from the heavy reference start line on the steel plate or girder.
6. Using the torque wrench, tighten the nut to the rotation value listed in Table F. The rotation is measured from the heavy reference line described in Step 5 made after the bolt was snug-tight. A second wrench shall be used to prevent rotation of the bolt head during tightening. Measure and record the moving torque after this rotation has been reached. The torque shall be measured with the nut in motion.

Table F

Nut Rotation Required for Turn-of-Nut Installation <sup>(a),(b)</sup>	
Bolt Length (measured in Step 1)	Required Rotation (turn)
4 bolt diameters or less	1/3

- (a) Nut rotation is relative to bolt, regardless of the element (nut or bolt) being turned. For bolts installed by 1/2 turn and less, the tolerance shall be plus or minus 30 degrees.
- (b) Applicable only to connections in which all material within grip of the bolt is steel.

7. Tighten the nut further to the 2/3-turn mark as indicated in Table G. The rotation is measured from the heavy reference start line made on the plate or girder when the bolt was snug-tight. Verify that the radial line on the bolt end or on the exposed portions of the threads of tension control bolts is still in alignment with the start line.

Table G

Required Nut Rotation for Rotational Capacity Test	
Bolt Length (measured in Step 1)	Required Rotation (turn)
4 bolt diameters or less	2/3

8. Loosen and remove the nut and examine the threads on both the nut and bolt.

C. Short Bolt Acceptance Criteria:

1. An assembly shall pass the following requirements to be acceptable: (1) the measured moving torque from Step 6 shall be less than or equal to the maximum allowable torque from Table E, (2) the nut shall be able to be removed from the bolt without signs of thread stripping or galling after the required rotation in Step 7 has been achieved, (3) the bolt does not shear from torsion or fail during the test, and (4) the assembly shall not seize before the final rotation in Step 7 is reached. Elongation of the bolt in the threaded region between the bearing face of the nut and the underside of the bolt head will not be considered a failure. Both fastener assemblies tested from one rotational capacity lot shall pass for the rotational capacity lot to be acceptable.

## **INSTALLATION TENSION TESTING AND ROTATIONAL CAPACITY TESTING AFTER ARRIVAL ON THE JOB SITE**

Installation tension tests and rotational capacity tests on high-strength fastener assemblies shall be performed by the Contractor prior to acceptance or installation and after arrival of the fastener assemblies on the project site. Installation tension tests and rotational capacity tests shall be performed at the job site, in the presence of the Engineer, on each rotational capacity lot of fastener assemblies.

The requirements of this section do not apply to high-strength cap screws or high-strength bolts used for slip base plates.

Installation tension tests shall be performed on 3 representative fastener assemblies in conformance with the provisions in Section 8, "Installation," of the RCSC Specification. For short bolts, Section 8.2, "Pretensioned Joints," of the RCSC Specification shall be replaced by the "Pre-Installation Testing Procedures," of the "Structural Bolting Handbook," published by the Steel Structures Technology Center, Incorporated.

The rotational capacity tests shall be performed in conformance with the requirements for rotational capacity tests in "Rotational Capacity Testing Prior to Shipment to Job Site" of these special provisions.

At the Contractor's expense, additional installation tension tests, tests required to determine job inspecting torque, and rotational capacity tests shall be performed by the Contractor on each rotational capacity lot, in the presence of the Engineer, if:

1. Any fastener is not used within 3 months after arrival on the job site,
2. Fasteners are improperly handled, stored, or subjected to inclement weather prior to final tightening,
3. Significant changes are noted in original surface condition of threads, washers, or nut lubricant, or
4. The Contractor's required inspection is not performed within 48 hours after all fasteners in a joint have been tensioned.

Failure of a job-site installation tension test or a rotational capacity test will be cause for rejection of unused fasteners that are part of the rotational capacity lot.

When direct tension indicators are used, installation verification tests shall be performed in conformance with Appendix Section X1.4 of ASTM Designation: F 959, except that bolts shall be initially tensioned to a value 5 percent greater than the minimum required bolt tension.

## **SURFACE PREPARATION**

For all bolted connections the following shall be cleaned and coated before assembly in conformance with the provisions for cleaning and painting structural steel of these special provisions:

1. Contact surfaces,
2. Outer surfaces of existing members that are within the grip and will be hidden by surfaces of outside existing members within the grip under bolt heads, nuts, and washers

## **SEALING**

When zinc-coated tension control bolts are used, the sheared end of each fastener shall be completely sealed with non-silicone type sealing compound conforming to the provisions in Federal Specification TT-S-230, Type II. The sealant shall be gray in color and shall have a minimum thickness of 50 mils. The sealant shall be applied to a clean sheared surface on the same day that the splined end is sheared off.

## **WELDING**

Table 2.2 of AWS D1.5 is superseded by the following table:

Base Metal Thickness of the Thicker Part Joined, inches	Minimum Effective Partial Joint Penetration Groove Weld Size*, inches
Over 1/4 to 1/2 inclusive	3/16
Over 1/2 to 3/4 inclusive	1/4
Over 3/4 to 1-1/2 inclusive	5/16
Over 1-1/2 to 2-1/4 inclusive	3/8
Over 2-1/4 to 6 inclusive	1/2
Over 6	5/8

\* Except the weld size need not exceed the thickness of the thinner part

The requirement of conformance with AWS D1.5 shall not apply to work conforming to Section 56-1, "Overhead Sign Structures," or Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications.

### **10-1.85 SIGN STRUCTURES**

Sign structures and foundations for overhead signs shall conform to the provisions in Section 56-1, "Overhead Sign Structures," of the Standard Specifications, "Steel Structures" of these special provisions, and the following requirements.

Before commencing fabrication of sign structures, the Contractor shall submit 2 sets of working drawings to the Engineer in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The working drawings shall include sign panel dimensions, span lengths, post heights, anchorage layouts, proposed splice locations, a snugging and tensioning pattern for anchor bolts and high-strength bolted connections, and details for permanent steel anchor bolt templates. The working drawings shall be supplemented with a written quality control program that includes methods, equipment, and personnel necessary to satisfy the requirements specified herein.

Working drawings shall be 22" x 34" or 11" x 17" in size and each drawing and calculation sheet shall include the State assigned designations for the sign structure type and reference as shown on the contract plans, District-County-Route-Post Mile, and contract number.

The Engineer shall have 30 days to review the sign structure working drawings after a complete submittal has been received. No fabrication or installation of sign structures shall be performed until the working drawings are approved in writing by the Engineer.

Should the Engineer fail to complete the review within the time allowance and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the sign structure working drawings, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Steel bolts not designated on the plans as high strength (HS) or stainless steel shall be for general applications and shall conform to the requirements in ASTM Designation: A 307.

A permanent steel template shall be used to maintain the proper anchor bolt spacing.

One top nut, one leveling nut, and 2 washers shall be provided for the upper threaded portion of each anchor bolt.

Flatness of surfaces for the following shall conform to the requirements in ASTM Designation: A 6/A 6M:

1. Base plates that are to come in contact with concrete, grout, or washers and leveling nuts
2. Plates in high-strength bolted connections

No holes shall be made in members unless the holes are shown on the plans or are approved in writing by the Engineer.

Longitudinal seam welds shall have 60 percent minimum penetration, except that within 6 inches of circumferential welds, longitudinal seam welds shall be complete joint penetration (CJP) groove welds. In addition, longitudinal seam welds on structures having telescopic pole segment splices shall be CJP groove welds on the female end for a length on each end equal to the designated slip fit splice length plus 6 inches.

Steel members used for overhead sign structures shall receive nondestructive testing (NDT) in conformance with AWS D1.1 and the following:

1.

Weld Location	Weld Type	Minimum Required NDT
Splice welds around the perimeter of tubular sections, poles, and arms.	CJP groove weld with backing ring	100% UT <sup>a</sup> or RT <sup>b</sup>
Longitudinal seam welds	CJP or PJP <sup>c</sup> groove weld	Random 25% MT <sup>d</sup>
Longitudinal seam welds within 6 inches of a circumferential splice.	CJP groove weld	100% UT or RT
Welds attaching base plates, flange plates, or pole or mast arm plates, to poles or arm tubes.	CJP groove weld with backing ring and reinforcing fillet	t > 3/16 inch: 100% UT and MT t < 3/16 inch: 100% MT after root weld pass and final weld pass t = pole or arm thickness
	External (top) fillet weld for socket-type connections	100% MT

- a ultrasonic testing
- b radiographic testing
- c partial joint penetration
- d magnetic particle testing

2. The acceptance and repair criteria for UT of welded joints where any of the members are less than 5/16 inch thick or where tubular sections are less than 13 inches in diameter shall conform to the requirements in AWS D1.1, Section 6.13.3.1. A written procedure approved by the Engineer shall be used when performing this UT. These written procedures shall conform to the requirements in AWS D1.1, Annex K. The acceptance and repair criteria for other welded joints receiving UT shall conform to the requirements in AWS D1.1, Section 6, Table 6.3 for cyclically loaded nontubular connections.
3. The acceptance and repair criteria for radiographic or real time image testing shall conform to the requirements of AWS D1.1 for tensile stress welds.
4. For longitudinal seam welds, the random locations for NDT will be selected by the Engineer. The cover pass shall be ground smooth at the locations to be tested. If repairs are required in a portion of a tested weld, the repaired portion shall receive NDT, and additional NDT shall be performed on untested portions of the weld. The additional NDT shall be performed on 25 percent of that longitudinal seam weld. After this additional NDT is performed and if more repairs are required, then that entire longitudinal seam weld shall receive NDT.

Circumferential welds and base plate to post welds may be repaired only one time without written permission from the Engineer.

All ferrous metal parts of tubular sign structures shall be galvanized and shall not be painted.

Full compensation for furnishing anchor bolt templates and for testing of welds shall be considered as included in the contract price paid per pound for furnish sign structure, and no additional compensation will be allowed therefor.

### 10-1.86 ROADSIDE SIGNS

Roadside signs shall be furnished and installed at the locations shown on the plans or where designated by the Engineer and in conformance with the provisions in Section 56-2, "Roadside Signs," of the Standard Specifications and these special provisions.

The Contractor shall furnish roadside sign panels in conformance with the provisions in "Furnish Sign" of these special provisions.

Wood posts shall be pressure treated after fabrication in conformance with the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," of the Standard Specifications and AWPAs Use Category System: UC4A, Commodity Specification A or B. Roadside signs mounted on concrete barriers will be measured and paid for by the pound as metal (barrier mounted sign).

The contract price paid per pound for metal (barrier mounted sign) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing metal (barrier mounted sign), complete in place, including installation of single or multiple sign panels on a single metal post, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Type N (CA), Type P (CA), and Type R (CA) marker panels mounted on a post with a roadside sign shall be considered to be sign panels and will not be paid for as markers.

#### **10-1.87 INSTALL SIGN PANEL ON EXISTING FRAME**

Sign panels shall be installed on existing frames at the locations shown on the plans or where designated by the Engineer and in conformance with the provisions in Section 56-1.06, "Sign Panels and Fastening Hardware," of the Standard Specifications and these special provisions.

The Contractor shall furnish sign panels in conformance with the provisions in "Furnish Sign" of these special provisions.

Existing sign panels, as shown on the plans, shall be removed and disposed of as provided in Section 15, "Existing Highway Facilities," of the Standard Specifications.

Installing sign panels on existing frames will be measured by the square foot and the quantity to be paid for will be the total area, in square feet, of sign panels installed in place.

The contract price paid per square foot for install sign panel on existing frame shall include full compensation for furnishing all labor, materials (except sign panels and mounting bolts), tools, equipment, and incidentals, and for doing all the work involved in installing sign panels on existing frames, complete in place (including removing, and disposing of existing sign panels), as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **10-1.88 INSTALL SIGN PANEL ON BARRIER/SOUND WALL**

Sign panels shall be installed on barrier/sound wall at the locations shown on the plans or where designated by the Engineer and in conformance with the provisions in Section 56-1.06, "Sign Panels and Fastening Hardware," of the Standard Specifications and these special provisions.

The Contractor shall furnish sign panels in conformance with the provisions in "Furnish Sign" of these special provisions.

Installing sign panels on barrier/sound wall will be measured by the unit from the actual count.

The contract price paid per unit for install sign panel on barrier/sound wall shall include full compensation for furnishing all labor, materials (except State-furnished sign panels and mounting bolts), tools, equipment, and incidentals, and for doing all the work involved in installing sign panels on barrier/sound wall, complete in place (including removing, salvaging, and disposing of existing sign panels), as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **10-1.89 INSTALL MEDIAN MILEAGE PANEL**

Median mileage panels shall be installed at the locations shown on the plans or where directed by the Engineer, and in conformance with these special provisions.

The Contractor shall furnish target plates in conformance with the provisions in "Furnish Sign" of these special provisions.

Installation holes in target plates shall be drilled or punched by the Contractor, after determination of type of installation. Target plates shall have only the necessary holes for the specified installation indicated.

Appropriate letters and numerals shall be affixed to the target plates by the Contractor in conformance to the requirements in Section 82-1.04, "Marker Information," of the Standard Specifications.

Concrete anchorage devices for installing median mileage panels shall be cast-in-place or resin capsule type, conforming to the provisions of Section 75-1.03, "Miscellaneous Bridge Metal," and as shown on the plans.

Installing median mileage panels will be measured by the unit determined from actual count of median mileage panels in place.

The contract unit price paid for install median mileage panel shall include full compensation for furnishing all labor, (including the affixing of the appropriate letters and numerals to the target plates and providing traffic control necessary to allow accurate and safe determination of median mileage panel locations), materials, hardware, tools, equipment, and incidentals, and for doing all the work involved in installing median mileage panels, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **10-1.90 FURNISH SIGN**

Signs shall be fabricated and furnished in accordance with details shown on the plans, the Traffic Sign Specifications, and these special provisions.

Traffic Sign Specifications for California sign codes are available for review at:

<http://www.dot.ca.gov/hq/traffops/signtech/signdel/specs.htm>

Traffic Sign Specifications for signs referenced with Federal MUTCD sign codes can be found in Standard Highway Signs Book, administered by the Federal Highway Administration, which is available for review at:

[http://mutcd.fhwa.dot.gov/ser-shs\\_millennium.htm](http://mutcd.fhwa.dot.gov/ser-shs_millennium.htm)

Information on cross-referencing California sign codes with the Federal MUTCD sign codes is available at:

<http://www.dot.ca.gov/hq/traffops/signtech/signdel/specs.htm>

Temporary or permanent signs shall be free from blemishes that may affect the serviceability and detract from the general sign color and appearance when viewing during daytime and nighttime from a distance of 25 feet. The face of each finished sign shall be uniform, flat, smooth, and free of defects, scratches, wrinkles, gel, hard spots, streaks, extrusion marks, and air bubbles. The front, back, and edges of the sign panels shall be free of router chatter marks, burns, sharp edges, loose rivets, delaminated skins, excessive adhesive over spray and aluminum marks.

### **QUALITY CONTROL FOR SIGNS**

The requirements of "Quality Control for Signs" in this section shall not apply to construction area signs.

No later than 14 days before sign fabrication, the Contractor shall submit a written copy of the quality control plan for signs to the Engineer for review. The Engineer will have 10 days to review the quality control plan. Sign fabrication shall not begin until the Engineer approves the Contractor's quality control plan in writing. The Contractor shall submit to the Engineer at least 3 copies of the approved quality control plan. The quality control plan shall include, but not be limited to the following requirements:

- A. Identification of the party responsible for quality control of signs,
- B. Basis of acceptance for incoming raw materials at the fabrication facility,
- C. Type, method and frequency of quality control testing at the fabrication facility,
- D. List (by manufacturer and product name) of process colors, protective overlay film, retroreflective sheeting and black non-reflective film,
- E. Recommended cleaning procedure for each product, and
- F. Method of packaging, transport and storage for signs.

No legend shall be installed at the project site. Legend shall include letters, numerals, tildes, bars, arrows, route shields, symbols, logos, borders, artwork, and miscellaneous characters. The style, font, size, and spacing of the legend shall conform to the Standard Alphabets published in the FHWA Standard Highway Signs Book. The legend shall be oriented in the same direction in accordance with the manufacturer's orientation marks found on the retroreflective sheeting.

On multiple panel signs, legend shall be placed across joints without affecting the size, shape, spacing, and appearance of the legend. Background and legend shall be wrapped around interior edges of formed panel signs as shown on plans to prevent delamination.

The following notation shall be placed on the lower right side of the back of each sign where the notation will not be blocked by the sign post or frame:

- A. PROPERTY OF STATE OF CALIFORNIA,
- B. Name of the sign manufacturer,
- C. Month and year of fabrication,
- D. Type of retroreflective sheeting, and
- E. Manufacturer's identification and lot number of retroreflective sheeting.

The above notation shall be applied directly to the aluminum sign panels in 1/4-inch upper case letters and numerals by die-stamp and applied by similar method to the fiberglass reinforced plastic signs. Painting, screening, or engraving the notation will not be allowed. The notation shall be applied without damaging the finish of the sign.

Signs with a protective overlay film shall be marked with a dot of 3/8 inch in diameter. The dot placed on white border shall be black, while the dot placed on black border shall be white. The dot shall be placed on the lower border of the sign before application of the protective overlay film and shall not be placed over the legend and bolt holes. The application method and exact location of the dot shall be determined by the manufacturer of the signs.

For sign panels that have a minor dimension of 48 inches or less, no splice will be allowed in the retroreflective sheet except for the splice produced during the manufacturing of the retroreflective sheeting. For sign panels that have a minor dimension greater than 48 inches, only one horizontal splice will be allowed in the retroreflective sheeting.

Unless specified by the manufacturer of the retroreflective sheeting, splices in retroreflective sheeting shall overlap by a minimum of one inch. Splices shall not be placed within 2 inches from edges of the panels. Except at the horizontal borders, the splices shall overlap in the direction from top to bottom of the sign to prevent moisture penetration. The retroreflective sheeting at the overlap shall not exhibit a color difference under the incident and reflected light.

Signs exhibiting a significant color difference between daytime and nighttime shall be replaced immediately.

Repairing sign panels will not be allowed except when approved by the Engineer.

The Department will inspect signs at the Contractor's facility and delivery location, and in accordance with Section 6, "Control of Materials," of the Standard Specifications. The Engineer will inspect signs for damage and defects before and after installation.

Regardless of kind, size, type, or whether delivered by the Contractor or by a common carrier, signs shall be protected by thorough wrapping, tarping, or other methods to ensure that signs are not damaged by weather conditions and during transit. Signs shall be dry during transit and shipped on pallets, in crates, or tier racks. Padding and protective materials shall be placed between signs as appropriate. Finished sign panels shall be transported and stored by method that protects the face of signs from damage. The Contractor shall replace wet, damaged, and defective signs.

Signs shall be stored in dry environment at all times. Signs shall not rest directly on the ground or become wet during storage. Signs, whether stored indoor or outdoor, shall be free standing. In areas of high heat and humidity signs shall be stored in enclosed climate-controlled trailers or containers. Signs shall be stored indoor if duration of the storage will exceed 30 days.

Screen processed signs shall be protected, transported and stored as recommended by the manufacturer of the retroreflective sheeting.

When requested, the Contractor shall provide the Engineer test samples of signs and materials used at various stages of production. Sign samples shall be 12" x 12" in size with applied background, letter or numeral, and border strip.

The Contractor shall assume the costs and responsibilities resulting from the use of patented materials, equipment, devices, and processes for the Contractor's work.

#### **SHEET ALUMINUM**

Alloy and temper designations for sheet aluminum shall be in accordance with ASTM Designation: B 209.

The Contractor shall furnish the Engineer a Certificate of Compliance in conformance with Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for the sheet aluminum.

Sheet aluminum shall be pretreated in accordance to ASTM Designation: B 449. Surface of the sheet aluminum shall be cleaned, deoxidized, and coated with a light and tightly adherent chromate conversion coating free of powdery residue. The conversion coating shall be Class 2 with a weight between 10 milligrams per square foot and 35 milligrams per square foot, and an average weight of 25 milligrams per square foot. Following the cleaning and coating process, the sheet aluminum shall be protected from exposure to grease, oils, dust, and contaminants.

Sheet aluminum shall be free of buckles, warps, dents, cockles, burrs, and defects resulting from fabrication.

Base plate for standard route marker shall be die cut.

#### **RETROREFLECTIVE SHEETING**

The Contractor shall furnish retroreflective sheeting for sign background and legend in conformance with ASTM Designation: D 4956 and "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

Retroreflective sheeting shall be applied to sign panels as recommended by the retroreflective sheeting manufacturer without stretching, tearing, and damage.

Class 1, 3, or 4 adhesive backing shall be used for Type II, III, IV, VII, VIII, and IX retroreflective sheeting. Class 2 adhesive backing may also be used for Type II retroreflective sheeting. The adhesive backing shall be pressure sensitive and fungus resistant.

When the color of the retroreflective sheeting determined from instrumental testing is in dispute, the Engineer's visual test will govern.

#### **PROCESS COLOR AND FILM**

The Contractor shall furnish and apply screened process color, non-reflective opaque black film, and protective overlay film of the type, kind, and product that are approved by the manufacturer of the retroreflective sheeting.

The Contractor shall furnish the Engineer a Certificate of Compliance in accordance to Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for the screened process color, non-reflective opaque black film, and protective overlay film.

The surface of the screened process color shall be flat and smooth. When the screened process colors determined from the instrumental testing in accordance to ASTM Designation: D 4956 are in dispute, the Engineer's visual test will govern.

The Contractor shall provide patterns, layouts, and set-ups necessary for the screened process.

The Contractor may use green, red, blue, and brown reverse-screened process colors for background and non-reflective opaque black film or black screened process color for legend. The coefficient of retroreflection for reverse-screened process colors on white retroreflective sheeting shall not be less than 70 percent of the coefficient of retroreflection specified in ASTM Designation: D 4956.

The screened process colors and non-reflective opaque black film shall have the same outdoor weatherability as that of the retroreflective sheeting.

After curing, screened process colors shall withstand removal when tested by applying 3M Company Scotch Brand Cellophane Tape No. 600 or equivalent tape over the color and removing with one quick motion at 90° angle.

### **SINGLE SHEET ALUMINUM SIGN**

Single sheet aluminum signs shall be fabricated and furnished with or without frame. The Contractor shall furnish the sheet aluminum in accordance to "Sheet Aluminum" of these special provisions. Single sheet aluminum signs shall be fabricated from sheet aluminum alloy 6061-T6 or 5052-H38.

Single sheet aluminum signs shall not have a vertical splice in the sheet aluminum. For signs with depth greater than 48 inches, one horizontal splice will be allowed in the sheet aluminum.

Framing for single sheet aluminum signs shall consist of aluminum channel or rectangular aluminum tubing. The framing shall have a length tolerance of  $\pm 1/8$  inch. The face sheet shall be affixed to the frame with rivets of 3/16-inch diameter. Rivets shall be placed within the web of channels and shall not be placed less than 1/2 inch from edges of the sign panels. Rivets shall be made of aluminum alloy 5052 and shall be anodized or treated with conversion coating to prevent corrosion. The exposed portion of rivets on the face of signs shall be the same color as the background or legend where the rivets are placed.

Finished signs shall be flat within a tolerance of  $\pm 1/32$  inch per linear foot when measured across the plane of the sign in all directions. The finished signs shall have an overall tolerance within  $\pm 1/8$  inch of the detailed dimensions.

Aluminum channels or rectangular aluminum tubings shall be welded together with the inert gas shielded-arc welding process using E4043 aluminum electrode filler wires as shown on the plans. Width of the filler shall be equal to wall thickness of smallest welded channel or tubing.

### **FIBERGLASS REINFORCED PLASTIC PANEL SIGN**

The Contractor shall furnish fiberglass reinforced plastic panel sign in accordance with ASTM Designation: D 3841 and "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

Fiberglass reinforced plastic shall be acrylic modified and ultraviolet stabilized for outdoor weatherability. The plastic shall contain additives designed to suppress fire ignition and flame propagation. When tested in accordance with the requirements in the ASTM Designation: D 635, the extent of burning shall not exceed one inch.

Fiberglass reinforced plastic shall be stabilized to prevent the release solvents and monomers. The front and back surfaces of the laminate shall be clean and free of constituents and releasing agents that can interfere with the bonding of retroreflective sheeting.

The fiberglass reinforced plastic panel sign shall be weather resistant Grade II thermoset polyester laminate.

The fiberglass reinforced plastic panels shall be minimum 0.135-inch thick. Finished fiberglass reinforced plastic panel signs shall be flat within a tolerance of  $\pm 1/32$  inch per linear foot when measured across the plane of the sign in all directions. The finished signs shall have an overall tolerance within  $\pm 1/8$  inch of the specified dimensions.

Color of fiberglass reinforced plastic panels shall be uniform gray within Munsell color range of N7.5 to N8.5.

Fiberglass reinforced plastic panels shall be cut from a single piece of laminate. Bolt holes shall be predrilled. The predrilled bolt holes, panel edges, and the front and back surfaces of the panels shall be true and smooth. The panel surfaces shall be free of visible cracks, pinholes, foreign inclusions, warping and wrinkles that can affect performance and serviceability.

### **LAMINATED PANEL SIGN**

Laminated panel signs shall consist of two sheet aluminum laminated to a honeycomb core and extruded aluminum frame to produce flat and rigid panels of one-inch or 2-1/2-inch nominal thickness.

The face of laminated panel signs shall be fabricated from sheet aluminum alloy 6061-T6 or 5052-H32 of 0.063-inch thickness. The back of laminated panel signs shall be fabricated from sheet aluminum alloy 3003-H14 of 0.040-inch thickness. The Contractor shall furnish sheet aluminum as provided in "Sheet Aluminum" of these special provisions.

The core material shall be phenolic impregnated kraft paper honeycomb and fungus resistant in accordance to Military Specification MIL-D-5272. The honeycomb cell size shall be 1/2 inch. Weight of the kraft paper shall be 80 pounds and impregnated minimum 18 percent by weight.

A laminating adhesive that can produce a resilient oil and water-resistant bond shall be used to adhere the extruded aluminum frame and the honeycomb core to the sheet aluminum. Edge and interior delamination occur when a 0.010-inch thick feeler gauge of 1/2 inch in length can be inserted into a depth of more than 1/2 inch between the extruded aluminum frame and the sheet aluminum. Laminated panel sign with delamination will be rejected.

Laminated panels shall be able to resist a wind load of 33 pounds per square foot for the following simple span lengths with a bending safety factor of 1.25:

Panel Type	Nominal Panel Thickness	Simple Span Length
A	one inch	9 feet 0 inch
B	one inch	9 feet 0 inch
	2-1/2 inch	14 feet 6 inches
H	2-1/2 inch	14 feet 6 inches

The tensile strength of laminated panels shall be at least 20 pounds per square inch when tested in accordance with the following modification and with ASTM Designations: C 297 and C 481, Cycle B after aging. Instead of spraying with hot water, the specimen shall be totally immersed in 158° F hot water. When requested by the Engineer or the Transportation Laboratory, at least one test sample of 12" x 12" in size shall be taken for every 2,000 square feet of the panel production cycle or of the total factory production order, whichever occurs first.

Rivets used to secure the sheet aluminum to the perimeter frame shall be fabricated from aluminum alloy 5052 and anodized or treated with a conversion coating to prevent corrosion. Size of the aluminum rivets shall be 3/16 inch in diameter and placed at the corners of the laminated panels. Color of the exposed portion of the rivets shall be the same color as the sign background or legend on which the rivets are placed. Rivets or stainless steel screws shall be placed in holes drilled during fabrication in the perimeter frame.

On laminated multiple panel signs, a closure H-Section shall be placed in the top channel of the bottom panel. Perimeter frame of adjoining panel shall accommodate the closure H-Section in the closed position.

For signs with a depth of 5 feet 0 inch or less, the laminated panels shall be fabricated with no horizontal joints, splices or seams. For signs with a depth of greater than 5 feet 0 inch, the laminated panels may be fabricated in two panels.

The face of laminated panels shall be flat with a tolerance of  $\pm 3/32$  inch per linear foot when measured across the plane of each panel in all directions. Where laminated panels adjoin, the gap between adjoining edges from one corner to the other corner shall not deviate by more than 1/32 inch. Non-adjoining edges from one corner to the other corner shall not deviate by more than 1/8 inch from a straight plane. The front and back sheet aluminum shall be flush with the perimeter frame. The panel edges shall be smooth.

Laminated panel signs shall be within +1/8 inch or -1/2 inch of the detailed dimensions. The difference in length between adjoining panels of multiple panel signs shall not be greater than 1/2 inch.

Roadside laminated panel signs shall be Type B. Type B panels shall have a nominal thickness of one inch or 2-1/2 inches.

The perimeter frame of Type B panels shall consist of extruded channel edges. The interior and exterior sides of the channels, except the sides touching the face and back sheet aluminum, shall be welded at the joint. Sealant shall be placed at the corners of the perimeter frame to prevent moisture penetration.

Each side of the vertical tube spacers of Type B panels shall be welded to the perimeter frame, except the sides touching the front and back sheet aluminum.

The Contractor shall furnish mounting hardware for roadside laminated panel signs, such as closure H-sections, lags, bolts, nuts, and washers.

### **FORMED PANEL SIGN**

Formed panel signs shall be fabricated from one continuous sheet aluminum alloy 5052-H32 of 0.063-inch thickness. The Contractor shall furnish sheet aluminum as provided in "Sheet Aluminum" of these special provisions.

The aluminum frame shall be affixed to the panel with aluminum rivets through the face of the sign panels. Color of the exposed portion of the rivets shall be the same color as the sign background or legend on which the rivets are placed.

The face of finished formed panel sign shall be flat with a tolerance of 1/8 inch per linear foot when measured across the plane of each panel in all directions.

The Contractor shall furnish mounting hardware for overhead formed panel signs. Hardware for the overhead formed panel signs shall include bolts, nuts, and washers.

The length and depth of the overhead formed panel signs shall be within  $\pm 1/16$  inch of the detailed dimension.

The formed edges of the overhead panel signs shall be square. The mounting holes shall be straight and perpendicular to the front and back surfaces of the formed edges at the spacing shown on the plans. Holes that are improperly spaced and placed at the wrong angle will be rejected.

## **MEASUREMENT AND PAYMENT**

Furnishing signs (except for construction area signs) will be measured by the square foot and the quantity to be paid for will be the total area, in square feet, of the sign panel types installed in place.

The contract price paid per square foot for furnish sign of the types specified in the Engineer's estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in fabricating and furnishing the signs, including and fastening hardware, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for furnishing and installing protective overlay on signs shall be considered as included in the contract price paid per square foot for furnish sign of the various types and no separate payment will be made therefor.

### **10-1.91 TIMBER LAGGING**

Timber lagging shall conform to the details shown on the plans and the provisions in Sections 57, "Timber Structures," and 58, "Preservative Treatment of Lumber, Timber and Piling," of the Standard Specifications and these special provisions.

All timber members shall be preservative treated Douglas fir of the grades shown on the plans. Timber members shall be full sawn to the dimensions shown on the plans.

Preservative treatment shall conform to AWPA Use Category System: UC4B, Commodity Specification A, except that chromated copper arsenate shall not be used.

Timbers shall be installed with mortar-tight joints.

### **10-1.92 ABUTMENT LUMBER BLOCKING**

Abutment lumber blocking, consisting of lumber blocking placed at abutments, shall be preservative treated wood conforming to the details shown on the plans, the provisions in Sections 57, "Timber Structures," and 58, "Preservative Treatment of Lumber, Timber and Piling," of the Standard Specifications, and these special provisions.

Abutment lumber blocking shall consist of either solid timbers, dimension lumber, or a combination of both. The minimum finished thickness of any lumber shall be 1-1/2 inches.

Care shall be taken to ensure that the minimum gap between the abutment lumber blocking and the concrete or steel surfaces, as shown on the plans, is maintained regardless of the arrangement of lumber sizes used. The abutment lumber blocking shall be of a stable configuration and may include joining together the individual pieces of lumber.

At locations where the abutment lumber blocking is exposed and accessible to the public, it shall be securely joined to prevent an individual from removing it without tools.

If requested by the Engineer, working drawings showing the proposed abutment lumber blocking sizes, arrangements and method of joining for all abutment lumber blocking shall be submitted to the Engineer for approval in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications.

Abutment lumber blocking pieces that are split, broken, or otherwise damaged by the Contractor's operations shall be replaced at the Contractor's expense.

Prior to placing abutment lumber blocking, existing forms and debris that interfere with the blocking shall be removed. Removing existing forms and debris will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Abutment lumber blocking shall be of the softwood species listed in AWPA Use Category System: Commodity Specification A, and shall have an allowable stress value for compression perpendicular to the grain of 300 psi or greater.

The minimum preservative treatment of abutment lumber blocking shall conform to the requirements in AWPA Use Category System: UC4B, Commodity Specification A, except that chromated copper arsenate shall not be used.

Any metal components used for abutment lumber blocking not included in Section 57-1.02B, "Structural Metal," or Section 57-1.02C, "Hardware," of the Standard Specifications shall conform to the provisions in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Abutment lumber blocking will be measured and paid for by the thousand foot board measure in the same manner as specified for treated or untreated lumber and timber in Section 57, "Timber Structures," of the Standard Specifications.

Full compensation for any metal components used for abutment lumber blocking not included in Section 57-1.02B, "Structural Metal" or Section 57-1.02C, "Hardware," of the Standard Specifications shall be considered as included in the contract price paid for abutment lumber blocking and no additional compensation will be allowed therefor.

### **10-1.93 CLEAN AND PAINT STRUCTURAL STEEL**

New metal surfaces and connections to existing steel shall be cleaned and painted in conformance with the provisions in Section 59-2, "Painting Structural Steel," Section 59-3, "Painting Galvanized Surfaces," and Section 91, "Paint," of the Standard Specifications and these special provisions.

## GENERAL

Proof of certification under the SSPC QP Certification Program must be submitted with your bid. Required certifications are as follows:

1. SSPC-QP 1
2. SSPC-QP 3, Enclosed Shop Facility or AISC Sophisticated Paint Endorsement Quality Program, P1-Enclosed

The existing paint systems consist of materials listed in "Existing Highway Facilities" of these special provisions.

Before performing any painting or paint removal, the Contractor shall submit to the Engineer, in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, 3 copies of a separate Painting Quality Work Plan (PQWP) for each item of work for which painting or paint removal is to be performed. As a minimum, each PQWP shall include the following:

1. The name of each Contractor or subcontractor to be used.
2. One copy each of all current ASTM and "SSPC: The Society for Protective Coatings" specifications or qualification procedures applicable to the painting or paint removal to be performed. These documents shall become the permanent property of the Department.
3. A copy of the coating manufacturer's guidelines and recommendations for surface preparation, painting, drying, curing, handling, shipping, and storage of painted structural steel, including testing methods and maximum allowable levels for soluble salts.
4. Proposed materials, methods, and equipment to be used.
5. Proof of each of any required certifications, SSPC-QP 1, SSPC-QP 2, SSPC-QP 3.

5.1. In lieu of certification in conformance with the requirements in SSPC-QP 2 for this project, the Contractor may submit written documentation showing conformance with the requirements in Sections 4.2 through 4.4 of SSPC-QP 2, Category A.

6. Proposed methods to control environmental conditions in accordance with the manufacturer's recommendations and these special provisions.
7. Proposed methods to protect the coating during curing, shipping, handling, and storage.
8. Proposed rinse water collection plan.
9. A detailed paint repair plan for the repair of damaged areas.
10. Procedures for containing blast media and water during application of coatings and coating repair of erected steel.
11. Examples of proposed daily reports for all testing to be performed, including type of testing, location, lot size, time, weather conditions, test personnel, and results.

Before submitting the PQWP, a prepainting meeting between the Engineer, the Contractor, and a representative from each entity performing painting for this project shall be held to discuss the requirements for the PQWP.

The Engineer shall have 20 days to review the PQWP submittal after a complete plan has been received. No painting or paint removal shall be performed until the PQWP for that work is approved by the Engineer. Should the Engineer fail to complete the review within this time allowance and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the PQWP, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The Engineer's approval of the Contractor's PQWP shall not relieve the Contractor of any responsibility under the contract for the successful completion of the work in conformity with the requirements of the plans and specifications.

The Contractor shall provide enclosures to permit cleaning and painting during inclement weather. Provisions shall be made to control atmospheric conditions inside the enclosures within specified limits during cleaning and painting operations, drying to solvent insolubility, and throughout the curing period in accordance with the manufacturer's recommendations and these special provisions. Full compensation for providing and maintaining such enclosures shall be considered as included in the prices paid for the various contract items of work requiring paint and no additional compensation will be allowed therefor.

Fresh, potable water with a maximum chloride content of 75 ppm and a maximum sulfate content of 200 ppm shall be used for water rinsing or pressure washing operations. No continuous recycling of rinse water will be permitted. If rinse water is collected into a tank and subsequent testing determines the collected water conforms to the specified requirements, reuse may be permitted by the Engineer if no collected water is added to the tank after sample collection for determination of conformance to specified requirements.

## **CLEANING**

New metal surfaces and areas of connections to existing steel, except where galvanized, shall be dry blast cleaned and dry spot blast cleaned, respectively, in conformance with the requirements in SSPC-SP 10, "Near White Blast Cleaning," of the "SSPC: The Society for Protective Coatings." Blast cleaning shall leave surfaces with a dense, uniform, angular anchor pattern of no less than 1.5 mils nor more than 3.5 mils as measured in conformance with the requirements in ASTM Designation: D 4417.

Prior to blast cleaning, areas of connections to existing steel shall be steam cleaned as provided in Section 59-2.05, "Steam Cleaning," of the Standard Specifications. The temperature of the steam produced shall be between 275° F and 375° F at the nozzle.

At the option of the Contractor, a pressure wash system with a nozzle pressure between 2,500 psi and 3,000 psi may be substituted for steam cleaning apparatus. Addition of biodegradable detergent to the pressure wash will not be required.

The areas of connections to existing steel to be dry spot blast cleaned shall consist of, as a minimum:

1. New and existing contact surfaces and existing member surfaces under bolt heads, nuts or washers of high-strength bolted connections,
2. Exposed bare surfaces of existing steel remaining after trimming, cutting, drilling or reaming, and
3. Areas of existing steel within a 4-inch radius measured in any direction from the point of application of heat for welding or flame cutting.

Mineral and slag abrasives used for blast cleaning steel surfaces shall conform to the requirements for Class A, Grade 2 to 3 abrasives contained in SSPC-AB 1, "Mineral and Slag Abrasives," of the "SSPC: The Society for Protective Coatings," and shall not contain hazardous material.

Steel abrasives used for blast cleaning steel surfaces shall comply with the requirements of SSPC-AB 3, "Ferrous Metallic Abrasive," of the "SSPC: The Society for Protective Coatings." If steel abrasive is recycled through shop or field abrasive blast cleaning units, the recycled abrasive shall conform to the requirements of SSPC-AB 2, "Specification for Cleanliness of Recycled Ferrous Metallic Abrasive," of the "SSPC: The Society for Protective Coatings."

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications and a Material Safety Data Sheet shall be furnished before use for each shipment of blast cleaning material for existing steel.

Abrasive blast cleaned surfaces shall be tested by the Contractor for soluble salts using a Class A or B retrieval method as described in Technology Guide 15, "Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates," of the "SSPC: The Society for Protective Coatings," and cleaned so the maximum level of soluble salts does not exceed the lesser of the coating manufacturer's written recommendations or 10 micrograms per square centimeter. Areas of abrasive blast cleaned steel shall be tested at the rate of 3 tests for the first 1,000 square feet prepared per day, and one test for each additional 1,000 square feet or portion thereof, at locations selected by the Engineer. When less than 1,000 square feet of surface area is prepared in a shift, at least 2 tests shall be performed. If levels of soluble salts exceed the maximum allowed by these special provisions, the entire area represented by the testing will be rejected. The Contractor shall perform additional cleaning and testing of rejected areas until soluble salt levels conform to these requirements.

Corners shall be chamfered to remove sharp edges.

Thermal cut edges (TCEs) to be painted shall be conditioned before blast cleaning by shallow grinding or other method approved by the Engineer to remove the thin, hardened layer of material resulting from resolidification during cooling.

Visually evident base metal surface irregularities and defects shall be removed in accordance with ASTM Designation: A 6 or AASHTO Designation: M 160 before blast cleaning steel. When material defects exposed by blast cleaning are removed, the blast profile shall be restored by either blast cleaning or by using mechanical tools in accordance with SSPC-SP 11, "Power Tool Cleaning to Bare Metal," of the "SSPC: The Society for Protective Coatings."

## **PAINTING**

Blast cleaned surfaces shall receive a single undercoat consisting of an inorganic zinc rich primer conforming to the requirements in AASHTO Designation: M 300, Type I or Type II, except that:

1. The first 3 sentences of Section 4.7, "Primer Field Performance Requirements," shall not apply for Type II primers, and
2. The entire Section 5.6.1 shall not apply for either type of inorganic zinc primer.

Type I primers selected for use shall meet the current applicable volatile organic compound limits for the air district in which the project is located.

Inorganic zinc rich primer shall be selected from the Department's Pre-Qualified Products List.

Inorganic zinc rich primer shall be used within 12 hours of initial mixing.

Application of inorganic zinc rich primer shall conform to the provisions in Section 59-2.13, "Application of Zinc-Rich Primer," of the Standard Specifications.

The single undercoat of inorganic zinc rich primer shall be applied to the required dry film thickness in 2 or more applications within 8 hours of the start of blast cleaning. Abrasive blast cleaned steel shall not be exposed to relative humidity exceeding 85 percent before application of inorganic zinc coating.

The total dry film thickness of all applications of the inorganic zinc undercoat, including the surfaces of outside existing members within the grip under bolt heads, nuts and washers, shall be not less than 4 mils nor more than 8 mils, except that the total dry film thickness on each faying (contact) surface of high strength bolted connections shall be between one mil and the maximum allowable dry film thickness for Class B coatings as determined by certified testing in conformance with Appendix A of the "Specification for Structural Joints Using ASTM A325 or A490 Bolts" of the Research Council on Structural Connections (RCSC Specification). Unless otherwise stated, all inorganic zinc rich primer used on faying surfaces shall meet the slip coefficient requirements for a Class B coating on blast-cleaned steel, as specified in the RCSC Specification. The Contractor shall provide results of certified testing showing the maximum allowable dry film thickness for the Class B coating from the qualifying tests for the coating chosen, and shall maintain the coating thickness on actual faying surfaces of the structure at or below this maximum allowable coating thickness.

Areas where mudcracking occurs in the inorganic zinc coating shall be blast cleaned and repainted with inorganic zinc rich primer to the specified thickness.

Steel surfaces coated with Type II inorganic zinc rich primer shall be protected from conditions that may cause the coating film to dissolve. The Contractor, at the Contractor's expense, shall repair areas where the coating has dissolved by blast cleaning and repainting with inorganic zinc rich primer to the specified thickness.

Dry spray, or overspray, as defined in the Steel Structures Painting Manual, Volume 1, "Good Painting Practice," of the "SSPC: The Society for Protective Coatings," shall be removed before application of subsequent coats or final acceptance. Removal of dry spray shall be by screening or other methods that minimize polishing of the inorganic zinc surface. The dry film thickness of the coating after removal of dry spray shall be in conformance with the provisions for applying the single undercoat, as specified herein.

The Contractor shall test the inorganic zinc undercoat before application of finish coats. The locations of the tests will be determined by the Engineer. The Contractor shall determine the sequence of the testing operations. The testing for adhesion and hardness shall be performed no sooner than 72 hours after application of the single undercoat of inorganic zinc coating. Satisfactory access shall be provided to allow the Engineer to determine the location of the tests.

The inorganic zinc coating shall pass the following tests:

1. The undercoat shall have a minimum adhesion to steel of 600 psi when measured using a self-aligning adhesion tester in conformance with the requirements in ASTM Designation: D 4541. The Engineer will select 3 locations per girder or 1,000 square feet of painted surface, whichever is less, for adhesion testing. If less than 1,000 square feet of steel is painted in a work shift, the Engineer will select 3 areas painted during the work shift for testing. If 2 or more of the locations tested fail to meet adhesion requirements, the entire area represented by the tests will be rejected. If one of the locations tested fails to meet adhesion requirements, an additional 3 locations shall be tested. Should any of the additional locations fail to meet adhesion requirements, the entire area represented by the tests will be rejected. The Contractor, at the Contractor's expense, shall repair the rejected area by blast cleaning and repainting with inorganic zinc rich primer to the specified thickness. Test locations for areas of inorganic zinc meeting adhesion testing requirements shall be repaired by application of organic zinc primer as specified in Section 91-1.04, "Materials," of the Standard Specifications to the specified minimum dry film thickness.
2. Areas where finish coats are to be applied shall be tested for soluble salts using a Class A or B retrieval method as described in Technology Guide 15, "Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates," of the "SSPC: The Society for Protective Coatings," and cleaned so the maximum level of soluble salts does not exceed the lesser of the manufacturer's written recommendations or 10 micrograms per square centimeter. Areas of inorganic zinc undercoat shall be tested at the rate of 3 tests for the first 1,000 square feet to be painted per day and one test for each additional 1,000 square feet or portion thereof at locations selected by the Engineer. When less than 1,000 square feet of surface area is painted in a shift, at least 2 tests shall be performed. If levels of soluble salts exceed the maximum allowed by these special provisions, the entire area represented by the testing will be rejected. The Contractor shall perform additional cleaning and testing of rejected areas until soluble salt levels conform to these requirements.
3. The inorganic zinc undercoat shall exhibit a solid, hard, and polished metal surface when firmly scraped with the knurled edge of a quarter. Inorganic zinc coating that is powdery, soft, or does not exhibit a polished metal surface, as determined by the Engineer, shall be repaired by the Contractor, at the Contractor's expense, by blast cleaning and repainting with inorganic zinc coating to the specified thickness.

### **Additional Requirements for Water Borne Inorganic Zinc Primers**

1. The surface pH of the inorganic zinc undercoat shall be tested by wetting the surface with de-ionized water for a minimum of 15 minutes but no longer than 30 minutes and applying pH paper with a capability of measuring in increments of 0.5 pH units. At least 2 surface pH readings shall be taken for every 500 square feet or portion thereof. If less than 500 square feet of steel is coated in a single shift or day, at least 2 surface pH readings shall be taken for primer applied during that period. Application of finish coats will not be permitted until the surface pH is less than or equal to 7.
2. Dry to solvent insolubility for water borne inorganic zinc primers shall be determined in conformance with the requirements in ASTM Designation: D 4752, except that water shall be the solvent. The resistance rating shall be not less than 4. Areas of inorganic zinc undercoat shall be tested for solvent insolubility at the rate of one test per 500 square feet or portion thereof. Inorganic zinc undercoat represented by the tested area that does not meet the solvent insolubility requirements will be rejected. The Contractor, at the Contractor's expense, shall repair rejected areas by blast cleaning and repainting with inorganic zinc rich primer to the specified thickness.

### **Additional Requirements for Solvent Borne Inorganic Zinc Primers**

1. Dry to solvent insolubility for solvent borne inorganic zinc primers shall be determined in conformance with the requirements in ASTM Designation: D 4752. The resistance rating shall be not less than 4. Areas of inorganic zinc undercoat shall be tested for solvent insolubility at the rate of one test per 500 square feet or portion thereof. Inorganic zinc undercoat represented by the tested area that does not meet the solvent insolubility requirements will be rejected. The Contractor, at the Contractor's expense, shall repair rejected areas by blast cleaning and repainting with inorganic zinc rich primer to the specified thickness.
2. Surface hardness of solvent borne inorganic zinc undercoat shall be a minimum 2H when measured in conformance with the requirements in ASTM Designation: D 3363. Areas of inorganic zinc undercoat shall be tested at the rate of one test per 500 square feet or portion thereof. Inorganic zinc undercoat that fails to meet the surface hardness requirements shall be repaired by the Contractor, at the Contractor's expense, by blast cleaning and repainting with inorganic zinc rich primer to the specified thickness.

The Contractor, at the Contractor's expense, shall retest all rejected areas of inorganic zinc undercoat after repairs have been completed.

Exposed areas of inorganic zinc undercoat shall receive a minimum of 2 finish coats of an exterior grade latex paint supplied by the manufacturer of the inorganic zinc rich primer.

All areas of inorganic zinc undercoat to receive finish coats shall be water rinsed in conformance with the requirements in Section 59-1.03, "Application," of the Standard Specifications and these special provisions. Areas of the coating removed by water rinsing shall be reapplied in conformance with Section 59-2.13, "Application of Zinc-Rich Primer," of the Standard Specifications and these special provisions. Except as approved by the Engineer, a minimum time of 72 hours shall be allowed between application of inorganic zinc coating and water rinsing.

The first finish coat shall be applied within 48 hours following the water rinsing.

The finish coat paint shall be formulated for application to inorganic zinc coating, shall meet the requirements for SSPC-Paint 24, "Latex Semi-Gloss Exterior Topcoat," of the "SSPC: The Society for Protective Coatings," and shall conform to the following:

1. No visible color change in the finish coats shall occur when tested for 800 hours in conformance with the requirements in ASTM Designation: D 4587, Test Cycle 2.
2. The vehicle shall be an acrylic or modified acrylic copolymer with a minimum of necessary additives.

The first finish coat shall be applied in 2 applications. The first application shall consist of a spray applied mist application. The second application shall be applied after the mist application has dried to a set to touch condition as determined by the procedure described in Section 7 of ASTM Designation: D 1640. The first finish coat color shall match color no. 34272 of FED-STD-595. The total dry film thickness of both applications of the first finish coat shall be not less than 2 mils.

Except as approved by the Engineer, a minimum drying time of 12 hours shall be allowed between finish coats.

The second finish coat color shall match color no. 14090 of FTD-STD-595. The total dry film thickness of all applications of the second finish coat shall be not less than 2 mils.

The 2 finish coats shall be applied in 3 or more applications to a total dry film thickness of not less than 4 mils nor more than 8 mils.

The total dry film thickness of all applications of inorganic zinc undercoat and finish coat paint shall be not less than 8 mils nor more than 14 mils.

Cleaning and painting of existing contact surfaces of high strength bolted connections that contain rust, loose paint, or other foreign substances, except loose dirt and dust, will be considered as extra work as specified in Section 4-1.03D, "Extra Work," of the Standard Specifications. Cost of repair of damage to existing paint caused by the Contractor's operations shall be borne by the Contractor.

### **MEASUREMENT AND PAYMENT**

Dry spot blast cleaning and undercoat painting of blast cleaned areas of existing surfaces will be measured by the square foot of spot blast cleaned areas, and will be paid for as spot blast clean and paint undercoat.

The contract price paid per square foot for spot blast clean and paint undercoat shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in dry spot blast cleaning and painting undercoat on the existing surfaces complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for clean and paint structural steel shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in cleaning and painting the exposed surfaces of the new structural steel and finish coat on undercoated areas of existing metal, complete in place, including water rinsing, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **10-1.94 ALTERNATIVE PIPE**

Alternative pipe culverts must comply with Section 62, "Alternative Culverts," of the Standard Specifications.

#### **10-1.95 PLASTIC PIPE**

Plastic pipe shall conform to the provisions in Section 64, "Plastic Pipe," of the Standard Specifications and these special provisions.

Plastic pipe for use as alternative pipe culvert must be high density polyethylene pipe with smooth interior.

Plastic pipe for water quality culverts at locations shown on the plans shall be Schedule 40 polyvinyl chloride (PVC).

#### **10-1.96 REINFORCED CONCRETE PIPE**

Reinforced concrete pipe shall conform to the provisions in Section 65, "Reinforced Concrete Pipe," of the Standard Specifications and these special provisions.

### **GENERAL**

Where embankment will not be placed over the top of the pipe, a relative compaction of not less than 85 percent shall be required below the pipe spring line for pipe installed using Method 1 backfill in trench, as shown on Standard Plan A62D. Where the pipe is to be placed under the traveled way, a relative compaction of not less than 90 percent shall be required unless the minimum distance between the top of the pipe and the pavement surface is the greater of 4 feet or one half of the outside diameter of the pipe.

Except as otherwise designated by classification on the plans or in the specifications, joints for culvert and drainage pipes shall conform to the plans or specifications for standard joints.

If reinforced concrete pipe is installed in conformance with the details shown on Standard Plan A62DA, the fifth paragraph of Section 19-3.04, "Water Control and Foundation Treatment," of the Standard Specifications shall not apply.

Where solid rock or other unyielding material is encountered at the planned elevation of the bottom of the bedding, shown on Standard Plan A62DA, the material below the bottom of the bedding shall be removed to a depth of 1/50 of the height of the embankment over the top of the culvert, but not less than 6 inches nor more than 12 inches. The resulting trench below the bottom of the bedding shall be backfilled with structure backfill material in conformance with the provisions in Section 19-3.06, "Structure Backfill," of the Standard Specifications. The Outer Bedding shall not be compacted prior to placement of the pipe.

### **MATERIALS**

The concrete for reinforced concrete pipe shall contain not less than 470 pounds of cementitious material per cubic yard and have a water-cementitious material ratio that does not exceed 0.40 by weight. Supplementary cementitious material is optional. Reinforcement shall have a minimum cover of 1 inch, except that for pipe with a nominal diameter of 18 inches or less the minimum cover shall be 3/4 inch.

Special reinforced concrete pipe, having concrete cover over the steel reinforcement greater than the cover specified in AASHTO Designation: M 170, shall conform to the provisions in Section 65-1.02, "Materials," and Section 65-1.02A, "Circular Reinforced Concrete Pipe," of the Standard Specifications, except the width of crack produced by the D-load test specified in AASHTO Designation: M 170 shall be the width determined by the following formula:

$$b = \frac{t - 3/8d}{t - 3/8d - C} \times 0.01 \text{ inch}$$

Where:

- b = Width of crack to be produced in lieu of the 0.01-inch crack specified in AASHTO Designation: M 170
- t = Wall thickness of pipe, inches
- d = Effective depth of the section to be tested, feet
- C = Concrete cover over steel reinforcement in excess of cover specified in AASHTO Designation: M 170

Reinforced concrete pipe that is to be hydrostatically tested shall be strength tested by the 3-edge bearing method to a maximum D-load of 10 percent greater than the 0.01-inch cracking D-load specified in AASHTO Designation: M 170 or to the actual D-load required to produce a 0.01-inch crack, whichever is the lesser.

Special oval shaped reinforced concrete pipe, having concrete cover over the steel reinforcement greater than the cover specified in AASHTO Designation: M 207, shall conform to the provisions in Section 65-1.02, "Materials," and Section 65-1.02B, "Oval Shaped Reinforced Concrete Pipe," of the Standard Specifications, except the width of crack produced by the D-load test specified in AASHTO Designation: M 207 shall be the width determined by the following formula:

$$b = \frac{t - 3/8d}{t - 3/8d - C} \times 0.01 \text{ inch}$$

Where:

- b = Width of crack to be produced in lieu of the 0.01-inch crack specified in AASHTO Designation: M 207
- t = Wall thickness of pipe, inches
- d = Effective depth of the section to be tested, feet
- C = Concrete cover over steel reinforcement in excess of cover specified in AASHTO Designation: M 207

Oval shaped reinforced concrete pipe that is to be hydrostatically tested shall be strength tested by the 3-edge bearing method to a maximum D-load of 10 percent greater than the 0.01-inch cracking D-load specified in AASHTO Designation: M 207 or to the actual D-load required to produce a 0.01-inch crack, whichever is the lesser.

#### **MEASUREMENT AND PAYMENT**

The excavation and backfill below the planned elevation of the bottom of the bedding shown on Standard Plan A62DA will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

The Department does not pay any additional cost for use of optional supplementary cementitious material.

The Department does not pay any additional cost for excess concrete cover over steel reinforcement.

#### **10-1.97 CORRUGATED METAL PIPE**

Corrugated steel pipe culverts shall conform to the provisions in Section 66, "Corrugated Metal Pipe," of the Standard Specifications and these special provisions.

Asphaltic mastic coating or polymeric sheet coating substituted for bituminous coating shall be placed on the outside and inside surfaces of the pipe.

#### **10-1.98 SPIRAL RIB PIPE**

##### **GENERAL**

##### **Summary**

Manufactured spiral rib pipe must comply with Section 66, "Corrugated Metal Pipe," of the Standard Specifications, except for profile and fabrication requirements, and must comply with these special provisions.

## **MATERIALS**

You must use spiral rib pipe fabricated with either:

1. Three rectangular ribs spaced midway between seams with ribs 3/4" wide x 3/4" high at a maximum rib pitch of 7-1/2 inches,
2. Two rectangular ribs and one half-circle rib equally spaced between seams with ribs 3/4" wide x 1" high at a maximum rib pitch of 11-1/2 inches with the half-circle rib diameter spaced midway between the rectangular ribs, or
3. Two rectangular ribs equally spaced between seams with ribs 3/4" wide x 1" high at a maximum rib pitch of 8-1/2 inches.

Rib pitch measured at right angles to the direction of the ribs may vary +/-1/2 inch.

Corrugated steel spiral rib pipe must be fabricated by continuous helical lock seam under Section 66-3.03C(1), "Fabrication by Continuous Lock Seam," of the Standard Specifications.

## **JOINTS**

Coupling bands for spiral rib pipe must comply with Section 66-1.07, "Coupling Bands," of the Standard Specifications. A coupling band shown on the plans or approved by the Engineer under Section 61-1.02, "Performance Requirements for Culvert and Drainage Pipe Joints," of the Standard Specifications, for use on a pipe corrugation of 2-2/3" x 1/2" for corrugated metal pipe may be used on spiral rib pipe having 2-2/3" x 1/2" rerolled annular ends.

### **10-1.99 SLOTTED CORRUGATED STEEL PIPE**

Slotted corrugated steel pipe must comply with Section 66-3.09, "Slotted Pipe," of the Standard Specifications and these special provisions.

## **MATERIALS**

### **Concrete Backfill**

Where plans show cement treated structure backfill use minor concrete for backfill or Class 3 concrete conforming to the provisions of Section 90, "Portland Cement Concrete," of the Standard Specifications, except that minor concrete shall contain not less than 525 pounds of cementitious material per cubic yard.

### **Slotted corrugated steel pipe**

Slotted corrugated steel pipe drain must have a 6-inch vertical dimension for grate and tapered spacers.

## **CONSTRUCTION**

Excavation must comply with Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications.

## **MEASUREMENT AND PAYMENT**

The length of slotted corrugated steel pipe to be paid will be the slope length measured along the centerline of the pipe as designated by the Engineer. Slotted corrugated steel pipe cut to fit a structure will be the length of pipe necessary to be placed before cutting, measured in 2-foot increments. Slotted corrugated steel pipe placed in excess of the length designated will not be paid for.

The contract price paid per linear foot for the different sizes of slotted corrugated steel pipe includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all of the work involved in installing slotted corrugated steel pipe, complete in place, including structure excavation and cement treated or concrete backfill and connecting slotted corrugated steel pipe to new or existing facilities, including concrete collars, reinforcement, or other connecting devices, specified in the Standard Specifications and these special provisions, as shown on the plans, and as directed by the Engineer.

### **10-1.100 UNDERDRAIN**

Perforated plastic pipe underdrains shall conform to the provisions in Section 68-1, "Underdrains," of the Standard Specifications.

### **10-1.101 MISCELLANEOUS FACILITIES**

Alternative flared end sections and steel pipe riser shall conform to the provisions in Section 70, "Miscellaneous Facilities," of the Standard Specifications.

### 10-1.102 SUBDRAIN (or OVERDRAIN)

#### GENERAL

##### Summary

Subdrain shall conform to the provisions in Section 68, "Subsurface Drains," of the Standard Specifications and these special provisions.

##### Submittals

Submit a Certificate of Compliance as specified in Section 6-1.07, "Certificates of Compliance" of the Standard Specifications for perforated polyvinyl chloride pipe.

#### MATERIALS

Polyvinyl chloride subdrain pipe must:

1. Be of the diameter shown on the plans.
2. Be Schedule 40 PVC.
3. Be manufactured in accordance to the requirements of ASTM D1785 for physical dimensions and tolerances.
4. Meet the requirements of ASTM Designation D 2665.
5. Have 2 rows of perforations at a radial spacing of 90 to 120 degrees. Size of pipe perforations shall be 1/4-inch maximum in diameter.

Permeable material shall be Class 2.

Filter fabric material shall be Class B, conforming to Section 88, "Filtration," of the Standard Specifications.

#### CONSTRUCTION

Install subdrain pipe system in accordance with the provisions in Section 68-1.03, "Underdrains," of the Standard Specifications.

#### MEASUREMENT AND PAYMENT

Measurement and payment of subdrain of the size listed in the Engineers Estimate shall conform to the provisions in Sections 68-1.04, "Measurement" and 68-1.05, "Payment" of the Standard Specifications.

### 10-1.103 GRATED LINE DRAIN

This work shall consist of furnishing and installing precast grated line drain, with necessary fittings, coupling systems, frames, grates and associated items as shown on the plans and in conformance with these special provisions.

The interior surface of the grated line drain, below the level of the frame and grate and associated connections, shall be smooth. Grated line drain channel sections shall be manufactured of monolithic polymer concrete with no side extensions.

Monolithic polymer concrete shall be made from a composition of aggregate and polyester resin or vinylester resin and shall have the following properties when tested as follows:

PROPERTY	ASTM TEST METHOD	VALUE
Tensile Strength, psi	C 307	1,450 min.
Compressive Strength, psi	C 579	11,600 min.
Bending Strength, psi	C 580	2,900 min.
Moisture Absorption, %	C 140	0.5 max.
Chemical Resistance	C 267	Pass
Freeze/Thaw, number of cycles w/o weight loss	C 666	1,600 min.

The manufacturer of the grated line drain shall furnish the Engineer a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Grated line drain frames and grates shall be manufactured of ductile iron conforming to the provisions in Section 75-1.02, "Miscellaneous Iron and Steel," of the Standard Specifications. The frames and grates need not be galvanized or coated with asphalt paint. Bolts, nuts, frame anchors, and other connecting hardware shall conform to the provisions in Section 75-1.02, "Miscellaneous Iron and Steel," of the Standard Specifications.

Frames and grates, when installed in conformance with the manufacturer's recommendations and these special provisions, shall be classified as heavy duty 25,000 proof load when tested in accordance with Commercial Item Description A-A-60005 for "Frames, Covers, Gratings, Steps, Manhole, Sump and Catch Basin." Frames and grates shall be matchmarked in pairs before delivery to the work and grates shall fit into the frames without rocking.

Frames shall be secured to the surrounding concrete backfill with steel anchoring rods as shown on the plans. Other methods may be used to secure the frame to the concrete backfill or grated line drain wall provided that a minimum pullout resistance of 685 pounds per foot of length of grated line drain frame is maintained.

Grates and frames shall be one piece unless shown on the plans to be removable. Removable grates shall be held in place by locking devices that are tamper resistant. Locking devices shall not constrict the waterway area of the grated line drain and shall be fully replaceable. Removable grates shall provide a minimum repetitive pullout resistance of 340 pounds per foot of length after completion of 1,000 hours of salt spray testing in conformance with the requirements in ASTM Designation: B 117. When a combination of one piece frame and grate and removable grates are used, the locations of the removable grates shall be as shown on the plans.

Except for grates installed within designated pedestrian paths of travel, grates shall accept inflow of runoff through openings. The openings shall consist of a minimum of 60 percent of the total top surface area of the grate, with individual openings or slots having a dimension not greater than 2 inches measured in the direction of the grated line drain flow line. Grates installed within designated pedestrian paths of travel shall be certified as conforming to the requirements of the "Americans with Disabilities Act."

Grated line drains shall be installed in trenches excavated to the lines and grades established by the Engineer. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the grated line drain.

Grated line drains shall be installed and jointed in conformance with the manufacturer's recommendations.

Grated line drains shall be installed to the lines and grades with sections closely jointed and secured to ensure that no separation of the line drains occurs during backfilling.

The frame or grate of the grated line drain shall not extend above the level of the surrounding concrete backfill.

Grated line drains shall be connected to new or existing drainage facilities as shown on the plans.

Excavation and backfill shall conform to the provisions in Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications.

Backfill for the grated line drains shall be either minor concrete or Class 3 concrete conforming to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications. Minor concrete shall contain not less than 506 pounds of cementitious material per cubic yard.

Concrete backfill shall be placed in the trench as shown on the plans. Concrete backfill shall be placed against undisturbed material at the sides and bottom of the trench and in a manner that will prevent floating or shifting of the grated line drain and voids in, or segregation of, the concrete. Foreign material which falls into the trench, before or during placement of the concrete, shall be immediately removed. Where necessary, earth plugs shall be constructed and compacted at the ends of the planned concrete backfill to contain the concrete within the trench.

Concrete backfill shall be finished flush with the adjacent surfacing.

The surface of the concrete shall be textured with a broom or burlap drag to produce a durable skid-resistant surface.

The length the grated line drain to be paid for will be the length measured by the linear foot along the pavement surface as designated by the Engineer. No payment will be made for grated line drain placed in excess of the designated length.

The contract price paid per linear foot for grated line drain shall include full compensation for furnishing all labor, materials (including frames and grates), tools, equipment, and incidentals, and for doing all the work involved in installing grated line drains, complete in place, including excavation and backfill, connecting grated line drains to new or existing facilities, concrete collars, reinforcement, and other connecting devices, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **10-1.104 WELDED STEEL PIPE CASING (BRIDGE)**

Welded steel pipe casings through bridges and under approach slabs shall be of the size shown and shall conform to the provisions in Section 70, "Miscellaneous Facilities," of the Standard Specifications and these special provisions.

Unless otherwise shown on the project plans, casings shall be installed at each abutment, and casings shall be extended to the greater of: (1) 5 feet beyond the approach slab, (2) 5 feet beyond the end of the adjacent wingwall, or (3) 20 feet beyond the abutment.

#### **WORKING DRAWINGS**

Working drawings for temporary support of casing pipe at the abutments shall be submitted for approval in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings" of the Standard Specifications.

## **MATERIALS**

### **Casing pipe**

Casing pipe shall be welded steel pipe conforming to the provisions in Section 70-1.02B, "Welded Steel Pipe," of the Standard Specifications, except that the pipe shall be treated in accordance with the following requirements, prior to shipping. Exterior surfaces of welded steel pipe shall be cleaned and coated in conformance with the requirements in ANSI/AWWA C213 or at the option of the Contractor, cleaned, primed, and coated in accordance with specifications of ANSI/AWWA C214.

### **Pipe wrapping tape**

Wrapping tapes for pipe in contact with the ground shall be a pressure sensitive polyvinyl chloride or polyethylene tape having thickness of 50 mils, minimum.

## **CONSTRUCTION**

If a blockout is provided in the bridge abutment wall for casing pipe, the space between the casing pipe and bridge abutment wall shall be filled with mortar conforming to the provisions in Section 51-1.135, "Mortar" of the Standard Specifications.

Openings for utilities through bridge superstructure concrete shall either be formed or shall consist of pipe sleeves.

### **Wrapping and coating pipe**

Damaged coating on steel pipe casing in contact with earth shall be wrapped as follows:

- A. Pipe to be wrapped shall be thoroughly cleaned and primed as recommended by the tape manufacturer.
- B. Tapes shall be tightly applied with 1/2 uniform lap, free from wrinkles and voids to provide not less than a 100—mil thickness.
- C. Field joints and fittings for wrapped pipe shall be covered by double wrapping 50—mil thick tape. Wrapping at joints shall extend a minimum of 6 inches over adjacent pipe coverings. Width of tape for wrapping fittings shall not exceed 2 inches. Adequate tension shall be applied so tape will conform closely to contours of joint.

Where a welded steel pipe casing passes through the abutment wall, the welded steel pipe casing shall be additionally wrapped with 2 layers of 15—pound asphalt-felt building paper, securely taped or wired in place.

## **MEASUREMENT AND PAYMENT**

Measurement and payment for welded steel pipe casing (bridge) for each size listed in the Engineers Estimate shall conform to the provisions in Sections 70-1.04, "Measurement" and 70-1.05, "Payment" of the Standard Specifications.

Full compensation for furnishing and installing mortar and building paper, casing, and other fittings shall be considered as included in the contract prices paid per linear foot for the sizes of welded steel pipe casing (bridge) involved, and no additional compensation will be allowed therefor.

### **10-1.105 SLOPE PROTECTION**

Slope protection shall be placed or constructed in conformance with the provisions in Section 72, "Slope Protection," of the Standard Specifications and these special provisions.

Rock slope protection fabric must be Class 8.

### **10-1.106 MISCELLANEOUS CONCRETE CONSTRUCTION**

Minor concrete (gutter) and minor concrete (stamped concrete) shall conform to the provisions in Section 73, "Concrete Curbs and Sidewalks," of the Standard Specifications and these special provisions.

Minor concrete (gutter) is measured and paid for by the cubic yard in the same manner as specified for minor concrete (miscellaneous construction) in Section 73-1.08, "Payment," of the Standard Specifications.

Aggregate for minor concrete (stamped concrete) shall conform to the grading specified for fine aggregate in Section 90-3.03, "Fine Aggregate Grading," of the Standard Specifications.

Samples of the colors specified for stamped concrete are available for review by prospective bidders at the office of the Department of Transportation 100 S. Main St. Los Angeles. Portland cement concrete closely conforming to the colors specified for stamped concrete are available through commercial concrete sources.

A sample of sufficient size, of each type and color of the stamped concrete, to demonstrate the stamped concrete, including color, curing and finishing compounds shall be submitted to the Engineer for written approval.

Stamped concrete shall not be placed on the project prior to approval by the Engineer of the samples prepared and submitted by the Contractor.

Welded wire fabric, of the size and type shown on the plans and conforming to the provisions in Section 52, "Reinforcement," of the Standard Specifications, shall be placed in the stamped concrete areas as shown on the plans.

Aggregate base shall be Class 2 and shall conform to the provisions in Section 26, "Aggregate Bases," of the Standard Specifications.

The respective pattern type for stamped concrete shall be placed at the locations shown on the plans, struck off and compacted until a layer of mortar is brought to the surface. The concrete shall be screeded to the required grade and cross section and floated to a uniform surface.

The forming tools for the stamped concrete shall be applied to form the patterned surfaces while the concrete is still in the plastic stage of set.

One set of forming tools for stamped concrete shall be delivered to the Engineer after completion of work.

Stamped concrete areas shall be cured by the curing compound method. The curing compound shall be curing compound (6) conforming to the provisions in Section 90-7.01B, "Curing Compound Method," of the Standard Specifications.

For payment purposes, the area in square feet of minor concrete (stamped concrete) will be determined from horizontal measurements of the finished stamped concrete.

The contract price paid per square foot for minor concrete (stamped concrete) shall include full compensation for furnishing all labor, materials (including welded wire fabric, where required, and aggregate base), tools, equipment, and incidentals, and for doing all the work involved in constructing stamped concrete, including colored concrete and stain, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **10-1.107 COLORED CONCRETE**

Colored concrete shall conform to the provisions in Section 51, "Concrete Structures," of the Standard Specifications and these special provisions.

Minor concrete (stamped concrete) shall be integrally pigmented concrete. The color shall conform to the details shown on the plans.

Color pigments shall be of high quality iron oxides conforming to ASTM C 979. The dosage shall not exceed 10 percent by weight of cementitious material in the concrete mix design.

The Contractor shall submit technical data and manufacturer's specifications for colored concrete components and a proposed plan for mixing, delivery, placement, finishing, and curing of the colored concrete. This plan shall be submitted to the Engineer for approval at least 20 days prior to placing colored concrete.

The Contractor shall monitor the water content, weight of cementitious materials, and size, weight, and color of aggregate to maintain consistency and accuracy of the mixed colored concrete. The Contractor shall schedule delivery of concrete to provide consistent mix times from batching until discharge. No water shall be added after a portion of the batch has been discharged.

When more than one concrete pump is used to place concrete, the Contractor shall designate the pumps to receive colored concrete. The designated pumps shall receive only colored concrete throughout the concrete placement operation.

Consistent finishing practices shall be used to ensure uniformity of texture and color.

Unless otherwise specified, curing of colored concrete shall be by the forms-in-place method or the curing compound method only and shall conform to Section 90-7.03, "Curing Structures," of the Standard Specifications and these special provisions. The curing compound used for curing colored concrete surfaces shall be clear or match the color of the colored concrete and shall be manufactured specifically for colored concrete. Curing compounds containing calcium chloride shall not be used. The time between completing surface finishing and applying curing compound shall be the same for each colored concrete component.

Surrounding exposed surfaces shall be protected during placement, finishing, and curing operations of colored concrete.

Full compensation for colored concrete shall be considered as included in the contract price paid per square foot for minor concrete (stamped concrete) and no separate payment will be made therefor.

#### **10-1.108 PREPARE AND STAIN CONCRETE**

This work shall consist of preparing and staining concrete surfaces where shown on the plans in conformance with the provisions in Section 59-6, "Painting Concrete," of the Standard Specifications and these special provisions.

Concrete stain shall be a water-based solution of metallic salts that penetrate and react with concrete to produce insoluble, abrasion-resistant color deposits. The stain shall contain dilute acid to etch concrete surfaces so that the staining ingredients can penetrate the concrete.

Concrete stain shall be formulated and applied so that the final color of the stained concrete matches color no.30266 of FED-STD-595.

The completed architectural texture stained concrete surfaces shall closely resemble the texture, color, and pattern of the referee sample located at Department of Transportation 100 S. Main St. Los Angeles.

The Contractor shall submit a copy of the stain manufacturer's recommendations and written application instructions to the Engineer not less than 7 days before applying concrete stain to test panels.

New concrete surfaces to be stained shall be cured in conformance with the provisions in Section 90-7.03, "Curing Structures," of the Standard Specifications and these special provisions.

Immediately before commencing work, the Contractor shall test concrete surfaces to be stained for acceptance of stain in conformance with the manufacturer's recommendations. Areas that resist accepting stain shall be cleaned as approved by the Engineer.

The Contractor shall apply the concrete stain in conformance with the manufacturer's recommendations and these special provisions. The stain shall be applied uniformly, working to avoid excessive rundown. The stain shall be worked into the concrete surface in circular motions with a nylon-bristled brush. Drips, puddles, or other irregularities shall be worked into the concrete.

After the last coat of stain has dried, the Contractor shall rinse stained surfaces with water and wet scrub surfaces with a stiff bristled nylon brush until the rinse water runs clear.

The Contractor shall protect adjacent surfaces during concrete staining operations.

Full compensation for prepare and stain concrete shall be considered as included in the contract price paid per per square foot for minor concrete (stamped concrete) and linear foot for concrete barriers with the architectural surface (textured concrete), and no separate payment will be made therefor.

#### **10-1.109 MISCELLANEOUS IRON AND STEEL**

Miscellaneous iron and steel shall conform to the provisions in Section 75, "Miscellaneous Metal," of the Standard Specifications.

#### **10-1.110 MISCELLANEOUS METAL (BRIDGE)**

Miscellaneous metal (bridge) shall conform to the provisions for miscellaneous bridge metal in Section 75, "Miscellaneous Metal," of the Standard Specifications and these special provisions.

Attention is directed to "Welding" of these special provisions.

Miscellaneous metal (bridge) shall consist of the miscellaneous bridge metal items listed in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications and the following:

- A. Bearing pad plates
- B. Bolts and associated hardware at bin type abutments

#### **10-1.111 ISOLATION CASING**

Isolation casing shall consist of furnishing and installing corrugated steel pipe isolation casing in conformance with the details shown on the plans, the provisions in Section 66, "Corrugated Metal Pipe," and Section 75, "Miscellaneous Metal," of the Standard Specifications and these special provisions.

Corrugated steel pipe shall be fabricated from zinc-coated steel sheet.

Steel cover plates, angle brackets, and concrete anchorage devices shall conform to the provisions in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Corrugated steel pipe edges shall be free of torn metal, burrs, and sharp edges. Sharp edges and edges that are marred, cut, or roughened in handling or installation, shall be slightly rounded by grinding or other suitable means prior to cleaning and painting.

All edges of the corrugated steel pipe shall be cleaned as specified in Section 59-2.06 "Hand Cleaning," of the Standard Specifications and painted with at least 2 applications of unthinned zinc-rich primer (organic vehicle type) conforming to the provisions in Section 91, "Paint." Aerosol cans shall not be used.

Neoprene strips shall conform to the provisions for strip waterstops in Section 51-1.145, "Strip Waterstops," of the Standard Specifications, except that protective board will not be required.

Slurry cement backfill shall conform to the provisions in Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications.

Structure backfill placed outside the isolation casing as shown on the plans shall be compacted to a relative compaction of not less than 95 percent. Ponding and jetting of the structure backfill will not be permitted.

## **MEASUREMENT AND PAYMENT**

Isolation casings will be measured and paid for in conformance with the provisions in Section 75 1.06, "Measurement," of the Standard Specifications and these special provisions.

The contract price paid per pound for isolation casing shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in furnishing and installing isolation casing, complete in place, including corrugated steel pipe, edge preparation, galvanized steel cover plates, angles and concrete anchorage devices; neoprene strips; and slurry cement backfill, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

### **10-1.112 BRIDGE DECK DRAINAGE SYSTEM**

Bridge deck drainage systems shall conform to the provisions for miscellaneous bridge metal in Section 75, "Miscellaneous Metal," of the Standard Specifications and these special provisions.

Self-tapping screws used for sleeve connections shall be hex-head stainless steel, installed in holes drilled to fit the self-tapping screws, conforming to the requirements of ASTM Designation: A 276, Type 304.

At the Contractor's option, fiberglass pipes and fittings with the same diameter and minimum bend radius as those shown on the plans may be substituted for welded steel pipe in deck drain systems.

Fiberglass pipe and fittings shall conform to the requirements in ASTM Designation: D 2996, and shall have a minimum short-term rupture strength of 30,000 psi. The adhesive type recommended by the manufacturer shall be used for joining pipe and fittings. Fiberglass pipe not enclosed in a box girder cell or encased in concrete shall be manufactured from ultraviolet-resistant resin pigmented with concrete-gray color, or be coated with a concrete-gray resin-rich exterior coating. Paint shall not be used. Fiberglass pipe treated with ultraviolet protection shall withstand a minimum of 2,500 hours of accelerated weathering when tested in conformance with the requirements in ASTM Designation: G 154. Lamps shall be UV-B (313 nm wavelength). The resting cycle shall be 4 hours of ultraviolet exposure at 140° F, and then 4 hours of condensate exposure at 120° F. After testing, the surface of the pipe shall exhibit no fiber exposure, crazing, or checking, and only a slight chalking or color change.

Support spacing for fiberglass pipe shall be the same as shown on the plans for welded steel pipe. Pipe supports shall have a width of not less than 1.5 inches.

A Certificate of Compliance for fiberglass pipe and fittings shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate of Compliance shall include all laboratory test results conforming to the provisions specified herein.

Couplings used to connect or fiberglass pipe to steel shall be threaded or flanged. The sleeve connections shown on the plans shall not be used for fiberglass pipe.

If fiberglass pipe is substituted for welded steel pipe, the quantity of drainage piping will be computed on the basis of the dimensions and details shown on the plans, and no change in the quantities to be paid for will be made because of the use of fiberglass pipe.

Bridge deck drainage systems will be measured and paid for by the pound in the same manner specified for miscellaneous metal (bridge) in Section 75-1.06, "Measurement," and Section 75-1.07, "Payment," of the Standard Specifications.

### **10-1.113 MISCELLANEOUS METAL (RESTRAINER-CABLE TYPE)**

Miscellaneous metal (restrainer-cable type) shall conform to the provisions for bridge joint restrainer units in Section 75-1.035, "Bridge Joint Restrainer Units," of the Standard Specifications and these special provisions.

New concrete adjacent to restrainers shall be placed prior to installing restrainers.

Cleaning and painting of existing contact surfaces of high strength bolted connections that contain rust, loose paint or other foreign substances, except loose dirt and dust, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications. Damage to existing paint caused by the Contractor's operations shall be repaired by the Contractor at the Contractor's expense.

Miscellaneous metal (restrainer-cable type) will be measured and paid for by the pound in the same manner specified for miscellaneous metal (restrainer) in Sections 75-1.06, "Measurement," and 75-1.07, "Payment," of the Standard Specifications.

### **10-1.114 CHAIN LINK FENCE**

Chain link fence shall be Type 6 and shall conform to the provisions in Section 80, "Fences," of the Standard Specifications.

### **10-1.115 CHAIN LINK WALK GATE**

Chain link walk gates shall be Type CL-5 and CL-6 conforming to the provisions in Section 80, "Fences," of the Standard Specifications and these special provisions.

Gates shall be installed in existing fences at the locations shown on the plans. Gate installations shall be complete with gate post, latch post, concrete footings, braces, truss rods, and hardware. Gate and latch posts shall be braced to the next existing line post as shown on the plans.

At each gate location, an existing line post shall be removed and the new gate installed so that the gate is centered on the post hole of the removed post. Holes resulting from the removal of line posts shall be backfilled.

Gate mounting and latching hardware shall not contain open-end slots for the fastening bolts.

Chain link fabric for gates shall be of the same mesh size as the existing fence in which the gates are installed.

Openings made in existing fences for installation of gates shall be closed during the working day in which the openings are made and when work is not in progress. Temporary closures shall be made with the existing fence fabric or with additional 6-foot chain link fabric as directed by the Engineer.

Full compensation for making the openings in existing fences, for temporary closing of the openings (including furnishing additional fence fabric if necessary), and for new posts, footings, hardware, braces, and truss rods shall be considered as included in the contract unit price paid for 8-foot chain link gate (Type CL-6) and 3-foot chain link gate (Type CL-5) and no additional compensation will be allowed therefor.

### **10-1.116 MARKERS AND DELINEATORS**

Markers and delineators shall conform to the provisions in Section 82, "Markers and Delineators," of the Standard Specifications and these special provisions.

Markers and delineators on flexible posts shall conform to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. Flexible posts shall be made from a flexible white plastic which shall be resistant to impact, ultraviolet light, ozone, and hydrocarbons. Flexible posts shall resist stiffening with age and shall be free of burns, discoloration, contamination, and other objectionable marks or defects which affect appearance or serviceability.

Retroreflective sheeting for metal and flexible target plates shall be the retroreflective sheeting designated for channelizers, markers, and delineators conforming to the requirements in ASTM Designation: D 4956-95 and in conformance with the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

### **10-1.117 METAL BEAM GUARD RAILING**

Metal beam guard railing shall be constructed in conformance with the provisions in Section 83-1, "Railings," of the Standard Specifications and these special provisions.

Attention is directed to "Order of Work" of these special provisions.

Line posts shall be wood. Blocks shall be wood or plastic.

#### **ALTERNATIVE IN-LINE TERMINAL SYSTEM**

Alternative in-line terminal system shall be furnished and installed as shown on the plans and in conformance with these special provisions.

The allowable alternatives for an in-line terminal system shall consist of one of the following or a Department approved equal.

- A. TERMINAL SYSTEM (TYPE SKT) - Terminal system (Type SKT) shall be a SKT 350 Sequential Kinking Terminal manufactured by Road Systems, Inc., located in Big Spring, Texas, and shall include items detailed for terminal system (Type SKT) shown on the plans. The SKT 350 Sequential Kinking Terminal can be obtained from the distributor, Universal Industrial Sales, P.O. Box 699, Pleasant Grove, UT 84062, telephone (801) 785-0505 or from the distributor, Gregory Highway Products, 4100 13<sup>th</sup> Street, S.W., Canton, OH 44708, telephone (330) 477-4800.
- B. TERMINAL SYSTEM (TYPE ET) - Terminal system (Type ET) shall be an ET-2000 PLUS (4-tube system) extruder terminal as manufactured by Trinity Industries, Inc., and shall include items detailed for terminal system (Type ET) shown on the plans. The ET-2000 PLUS (4-tube system) extruder terminal can be obtained from the manufacturer, Trinity Industries, Inc., P.O. Box 99, 950 West 400S, Centerville, UT 84014, telephone (800) 772-7976.

The Contractor shall provide the Engineer with a Certificate of Compliance from the manufacturer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate of Compliance shall certify that the terminal systems furnished conform to the contract plans and specifications, conform to the prequalified design and material requirements, and were manufactured in conformance with the approved quality control program.

Terminal systems shall be installed in conformance with the manufacturer's installation instructions and these requirements. Each terminal system installed shall be identified by painting the type of terminal system in neat black letters and figures 2 inches high on the backside of the rail element between system posts numbers 4 and 5.

For terminal system (Type ET) the steel foundation tubes with soil plates attached shall be, at the Contractor's option, either driven, with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes shall be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer shall be moistened and thoroughly compacted. The wood terminal posts shall be inserted into the steel foundation tubes by hand and shall not be driven. Before the wood terminal posts are inserted, the inside surfaces of the steel foundation tubes to receive the wood posts shall be coated with a grease which will not melt or run at a temperature of 149° F or less. The edges of the wood terminal posts may be slightly rounded to facilitate insertion of the post into the steel foundation tubes.

For terminal system (Type SKT) the soil tubes shall be, at the Contractor's option, driven with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes shall be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer shall be moistened and thoroughly compacted. Wood posts shall be inserted into the steel foundation tubes by hand. Before the wood terminal posts are inserted, the inside surfaces of the steel foundation tubes to receive the wood posts shall be coated with a grease which will not melt or run at a temperature of 149° F or less. The edges of the wood posts may be slightly rounded to facilitate insertion of the post into the steel foundation tubes.

Surplus excavated material remaining after the terminal system has been installed shall be disposed of in a uniform manner along the adjacent roadway where designated by the Engineer.

The contract unit price paid for alternative in-line terminal system shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing alternative in-line terminal system, complete in place, including excavation, backfill and disposal of surplus material, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **ALTERNATIVE FLARED TERMINAL SYSTEM**

Alternative flared terminal system shall be furnished and installed as shown on the plans and in conformance with these special provisions.

The allowable alternatives for a flared terminal system shall consist of one of the following or a Department approved equal.

- A. **TERMINAL SYSTEM (TYPE FLEAT)** - Terminal system (Type FLEAT) shall be a Flared Energy Absorbing Terminal 350 manufactured by Road Systems, Inc., located in Big Spring, Texas, and shall include items detailed for terminal system (Type FLEAT) shown on the plans. The Flared Energy Absorbing Terminal 350 can be obtained from the distributor, Universal Industrial Sales, P.O. Box 699, Pleasant Grove, UT 84062, telephone (801) 785-0505 or from the distributor, Gregory Highway Products, 4100 13<sup>th</sup> Street, S.W., Canton, OH 44708, telephone (330) 477-4800.
- B. **TERMINAL SYSTEM (TYPE SRT)** - Terminal system (Type SRT) shall be an SRT-350 Slotted Rail Terminal (8-post system) as manufactured by Trinity Industries, Inc., and shall include items detailed for terminal system (Type SRT) shown on the plans. The SRT-350 Slotted Rail Terminal (8-post system) can be obtained from the manufacturer, Trinity Industries, Inc., P.O. Box 99, 950 West 400S, Centerville, UT 84014, telephone (800) 772-7976.

The Contractor shall provide the Engineer with a Certificate of Compliance from the manufacturer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate of Compliance shall certify that the terminal systems furnished conform to the contract plans and specifications, conform to the prequalified design and material requirements, and were manufactured in conformance with the approved quality control program.

Terminal systems shall be installed in conformance with the manufacturer's installation instructions and these requirements. Each terminal system installed shall be identified by painting the type of terminal system in neat black letters and figures 2 inches high on the backside of the rail element between system posts numbers 4 and 5.

For terminal system (Type SRT), the steel foundation tubes with soil plates attached shall be, at the Contractor's option, either driven, with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes shall be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer shall be moistened and thoroughly compacted. The wood terminal posts shall be inserted into the steel foundation tubes by hand and shall not be driven. Before the wood terminal posts are inserted, the inside surfaces of the steel foundation tubes to receive the wood posts shall be coated with a grease which will not melt or run at a temperature of 149° F or less. The edges of the wood terminal posts may be slightly rounded to facilitate insertion of the post into the steel foundation tubes.

For terminal system (Type FLEAT), the soil tubes shall be, at the Contractor's option, driven with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes shall be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer shall be moistened and thoroughly compacted. Wood posts shall be inserted into the steel foundation tubes by hand. Before the wood terminal posts are inserted, the inside surfaces of the steel foundation tubes to receive the wood posts shall be coated with a grease which will not melt or run at a temperature of 149° F or less. The edges of the wood posts may be slightly rounded to facilitate insertion of the post into the steel foundation tubes.

Surplus excavated material remaining after the terminal system has been installed shall be disposed of in a uniform manner along the adjacent roadway where designated by the Engineer.

The contract unit price paid for alternative flared terminal system shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing alternative flared terminal system, complete in place, including excavation, backfill and disposal of surplus material, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **10-1.118 CHAIN LINK RAILING**

Chain link railing shall conform to the provisions in Section 83-1, "Railings," of the Standard Specifications and these special provisions.

The chain link fabric shall be 9-gage (0.148-inch diameter), Type IV, Class B, bonded vinyl coated fabric, conforming to the requirements in AASHTO Designation: M 181.

The strength of the bond between the coating material and steel of the bonded vinyl coated chain link fabric shall be equal to or greater than the cohesive strength of the polyvinyl chloride (PVC) coating material.

#### **10-1.119 MOVEABLE CONCRETE BARRIER**

Where shown on the plans, Moveable Concrete Barrier (MCB) shall be placed and shifted by a barrier transfer and transport machine as specified in these special provisions.

Attention is directed to "Maintaining Traffic" and "Traffic Control System For Lane Closure" of these special provisions.

Where MCB is used as barrier along a lane closure, moving MCB into place and shifting MCB to planned storage locations shall be performed when lane closures are allowed for the lanes involved. Transfer and transport vehicles shall not encroach onto lanes open to public traffic during barrier shifting operations. Where locations of barriers require that transfer and transport machines be operated in adjacent traffic lanes, the adjacent lanes shall be closed during placement and removal of barriers by the transfer and transport machine. The Contractor shall conduct work so operations of the transfer and transport machine, including closure of adjacent lanes, are performed during hours when lane closures are allowed for the lanes involved.

MCB and the transfer and transport vehicles shall be as manufactured by Barrier Systems, Inc., 333 Vaca Valley Parkway, Suite 800, Vacaville, CA 95688, telephone (707) 374-6800. MCB shall be 200 Series. A backup transfer and transport machine shall be available if the primary transfer and transport machine is inoperable.

Arrangements have been made with the manufacturer of the MCB to insure that any successful bidder can lease the Moveable Concrete Barrier and transfer and transport vehicle from the above named source.

The price quoted by the manufacturer for the above Moveable Concrete Barrier will be \$50 per linear foot based upon a 9 month lease, F.O.B., a location within 100 miles of the jobsite. The lessee shall load, transport and install barriers. If barriers are not available within 100 miles, Barrier Systems, Inc., will pay approximately 1.5 cents per mile per foot to transport barriers to within 100 miles. The total shipping distance will not exceed 300 miles.

The price quoted by the manufacturer for the transfer and transport machine will be \$138,000.00 per unit based upon a 9 month lease, F.O.B., 180 River Road, Rio Vista, California 94571.

Taxes are not included in the foregoing unit prices and are the responsibility of the Contractor.

The above prices will be firm for all orders placed on or before November 1, 2011, provided delivery is accepted within 120 days after the order is placed.

The Contractor shall provide trained operators for transfer and transport machines, and machines shall be maintained, including fueling and lubrication, by the Contractor. Damaged MCB units shall be replaced by the Contractor. Transfer and transport machines damaged or not in good working order shall be repaired or replaced by the Contractor at Contractor's expense. If damage to MCB or transfer and transport machines was caused by public traffic, as determined by the Engineer, the State will bear the cost of repair or replacement of machines or MCB units involved.

The contract lump sum price paid for moveable concrete barrier shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in loading, hauling, unloading, storing, placing, moving (regardless of the number of times the barrier is placed or moved) and when no longer required, removing from the project, complete in place, including furnishing, operating, maintaining and storing transfer and transport machines, as shown on the plans, as specified in these special provisions, and as directed by the Engineer.

Full compensation for transfer and transport machine protective facilities as shown on the plans shall be considered as included in the contract lump sum price paid for moveable concrete barrier and no separate payment will be made therefor.

Full compensation for reflectors and adhesive for MCB shall be considered as included in the contract lump sum price paid for moveable concrete barrier and no separate payment will be made therefor.

Full compensation for installing temporary railing (Type K), if elected by the Contractor in lieu of Moveable Concrete Barrier at one to 10 tapers of MCB (work location) shall be considered as included in the contract lump sum price paid for moveable concrete barrier and no separate payment will be made therefor.

**10-1.120 CABLE RAILING**

Cable railing shall conform to the provisions in Section 83-1, "Railings," of the Standard Specifications.

**10-1.121 CONCRETE BARRIER**

Concrete barriers shall conform to the provisions in Section 83-2, "Barriers," of the Standard Specifications and these special provisions.

All concrete barrier (Type 60), (Type 60G), (Type 60GC), (Type 60GCR), (Type 60S), (Type 60SC), (Type 60SE), (Type 60SW Mod), (Type 60W Mod) and (Type 60R) shall have Architectural Surface (Textured Concrete) applied to both sides of the barrier.

If reinforcement is encountered during drilling before the specified depth is attained, the Engineer shall be notified. Unless the Engineer approves coring through the reinforcement, the hole will be rejected and the Contractor shall drill a new hole adjacent to the rejected hole to the depth shown on the plans.

New metal cover plates that are incorporated into various concrete barriers shall conform to the provisions in Section 75, "Miscellaneous Metals," of the Standard Specifications.

Concrete barrier (Type 60D Mod) will be measured and paid for as concrete barrier (Type 60D).

Concrete barrier transitions from concrete barrier (Type 27SV) to concrete barrier (Type 732SV) will be measured and paid for as concrete barrier (Type 732SV)

Concrete barrier transitions from concrete barrier (Type 60G) to concrete barrier (Type 60S) will be measured and paid for as concrete barrier (Type 60G)

Concrete barrier transitions from concrete barrier (Type 60) to concrete barrier (Type 50) will be measured and paid for as concrete barrier (Type 60)

Concrete barrier transitions from concrete barrier (Type 60S) to concrete barrier (Type 50) will be measured and paid for as concrete barrier (Type 60S)

Concrete barrier transitions from concrete barrier (Type 60) to concrete barrier (Type 60S) will be measured and paid for as concrete barrier (Type 60)

Full compensation for concrete barrier end anchorage and for furnishing and installing metal cover plate closures on various concrete barrier shall be considered as included in the contract price paid for various concrete barriers and no separate payment will be made therefor.

**10-1.122 TRANSITION RAILING (TYPE WB)**

Transition railing (Type WB) shall be furnished and installed in conformance with details shown on the plans, the provisions in Section 83-2, "Barriers," of the Standard Specifications and these special provisions.

The 10-gage rail elements shall conform to the requirements of Class B, Type 1 thrie beam guard railing as shown in AASHTO Designation: M 180. End caps shall conform to the requirements of Class A, Type 1 thrie beam guard railing as shown in AASHTO Designation: M 180.

Surplus excavated material remaining after the transitional railing (Type WB) has been constructed shall be disposed of in a uniform manner along the adjacent roadway where designated by the Engineer.

The contract unit price paid for transition railing (Type WB) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing transition railing (Type WB), complete in place, including drilling holes for wood posts, driving posts, backfill, and disposal of surplus material, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

**10-1.123 CRASH CUSHION (REACT)**

Crash cushion (REACT) shall be furnished and installed as shown on the plans and in conformance with the provisions in the Standard Specifications and these special provisions.

Crash cushion (REACT) shall be a multiple recoverable type, manufactured by Energy Absorption Systems, Inc. Crash cushion (REACT) and additional components shall conform to the descriptions as follows:

Contract Item Description	Manufacturer's Product Description
Crash Cushion (REACT 9CBB)	REACT 350.9 Concrete Side Mount

The successful bidder can obtain from the following distributors the crash cushion (REACT) manufactured by Energy Absorption Systems, Inc. at 35 East Wacker Drive, Suite 1100, Chicago, IL 60601:

1. Northern California: Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828, telephone (800) 884-8274, FAX (916) 387-9734
2. Southern California: Traffic Control Service, Inc., 1818 E. Orangethorpe, Fullerton, CA 92831-5324, telephone (800) 222-8274, FAX (714) 526-9501

The price quoted by the manufacturer for Crash Cushion (REACT 9CBB), FOB Pell City, Alabama is \$35,130, not including sales tax. The above prices will be firm for orders placed within 30 days of contract award, and provided delivery is accepted within 90 days after the order is placed.

The price quoted for crash cushion (REACT 9CBB) includes the concrete anchorage devices, but does not include the concrete anchor slab or the concrete backup block.

Crash cushion shall be installed in conformance with the manufacturer's recommendations.

Concrete anchorage devices used for attaching the crash cushion to the base slab shall be limited to those which have been provided by the manufacturer.

The concrete anchor slab shall conform to the provisions in Section 51, "Concrete Structures," and Section 52, "Reinforcement," of the Standard Specifications and these special provisions.

The concrete anchor slab and backup block shall be constructed of concrete containing not less than 590 pounds of cementitious material per cubic yard.

The concrete anchor slab and backup block shall be constructed of concrete containing not less than 674 pounds of cementitious material per cubic yard and incorporating an air-entraining admixture conforming to the provisions in Section 90-4, "Admixtures," of the Standard Specifications.

The Contractor shall furnish the Engineer one copy of the manufacturer's plan and parts list for each model installed.

The Contractor shall provide the Engineer with a Certificate of Compliance from the manufacturer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate of Compliance shall certify that crash cushion conforms with the contract plans and specifications, and conforms to the prequalified design and material requirements.

Crash cushion will be measured by the unit as determined from actual count in place in the completed work.

The contract unit prices paid for crash cushion (REACT 9CBB) shall include full compensation for furnishing all labor, materials (including anchor bolts, nuts, washers, and marker panels), tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing the crash cushions, complete in place, including structure excavation, structure backfill, and concrete anchor slab and backup block with bar reinforcing steel, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **10-1.124 CRASH CUSHION, SAND FILLED**

Sand filled crash cushions shall be furnished and installed as shown on the plans and in conformance with these special provisions.

A sand filled crash cushion shall consist of a grouping of sand filled modules.

Crash cushions shall be installed at the following locations:

North bound route 710 ("Conn 2" Line) at Station 1230+20, Olympic blvd. off ramp.

North bound route 710 at Station 1159+75, Atlantic blvd. off ramp.

At the Contractor's option, modules for use in sand filled crash cushions shall be either Energite III Inertial Modules, Fitch Inertial Modules or Traffix Sand Barrels manufactured after March 31, 1997, or equal:

1. Energite III and Fitch Inertial Modules, manufactured by Energy Absorption Systems, Inc., 35 East Wacker Drive, Suite 1100, Chicago, IL 60601:
  - 1.1. Northern California: Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828, telephone (800) 884-8274, FAX (916) 387-9734
  - 1.2. Southern California: Traffic Control Service, Inc., 1818 E. Orangethorpe, Fullerton, CA 92831-5324, telephone (800) 222-8274, FAX (714) 526-9501

2. TraFFix Sand Barrels, manufactured by TraFFix Devices, Inc., 220 Calle Pintoresco, San Clemente, CA 92672, telephone (949) 361-5663, FAX (949) 361-9205
  - 2.1. Northern California: United Rentals, Inc., 1533 Berger Drive, San Jose, CA 95112, telephone (408) 287-4303, FAX (408) 287-1929
  - 2.2. Southern California: Statewide Safety & Sign, Inc., P.O. Box 1440, Pismo Beach, CA 93448, telephone (800) 559-7080, FAX (805) 929-5786

Modules contained in the crash cushion shall be of the same type at each location. The color of the modules shall be the standard yellow color as furnished by the vendor, with black lids. The exterior components of the modules shall be formulated or processed to resist deterioration from ambient ultraviolet rays. The modules shall exhibit good workmanship free from structural flaws and objectionable surface defects.

The Contractor shall provide the Engineer with a Certificate of Compliance from the manufacturer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate of Compliance shall certify that the crash cushions comply with the contract plans and specifications, conform to the prequalified design and material requirements, and were manufactured in conformance with the approved quality control program.

Sand for filling the modules shall be clean washed concrete sand of commercial quality. At the time of placing in the modules, the sand shall contain not more than 7 percent water, as determined by California Test 226.

Modules placed on bridge decks shall be provided with positioning blocks fastened to the deck surface. Positioning blocks shall be shaped as segments of a ring and placed along the inner or outer periphery of the module wall. A minimum of 2 blocks, a minimum of one-sixth of a ring in length shall be provided for each module. Positioning blocks and fasteners shall be of a material that is corrosion and water resistant.

Module cylinders shall be filled with sand in conformance with the manufacturer's directions and to the sand capacity in pounds for each module shown on the plans.

Lids shall be securely attached as recommended by the manufacturer.

A Type R or Type P marker panel shall be attached to the front of the crash cushion as shown on the plans, when the closest point of the crash cushion array is within 12 feet of the traveled way. The marker panel, when required, shall be firmly fastened to the crash cushion with commercial quality hardware or by other methods approved by the Engineer.

Sand filled crash cushions, regardless of the number of modules required in each sand filled crash cushion, will be measured and paid for by the unit as crash cushion, sand filled. The quantity to be paid for will be determined from actual count of the units in place in the completed work.

The contract unit price paid for crash cushion, sand filled shall include full compensation for furnishing all labor, materials (including sand and marker panels), tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing crash cushions, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

#### **10-1.125 THERMOPLASTIC TRAFFIC STRIPE AND PAVEMENT MARKING**

Thermoplastic traffic stripes (traffic lines) and pavement markings shall be applied in conformance with the provisions in Section 84, "Traffic Stripes and Pavement Markings," of the Standard Specifications and these special provisions.

Thermoplastic material shall be free of lead and chromium, and shall conform to the requirements in State Specification PTH-02ALKYD.

Retroreflectivity of the thermoplastic traffic stripes and pavement markings shall conform to the requirements in ASTM Designation: D 6359-99. White thermoplastic traffic stripes and pavement markings shall have a minimum initial retroreflectivity of  $250 \text{ mcd m}^{-2} \text{ lx}^{-1}$ . Yellow thermoplastic traffic stripes and pavement markings shall have a minimum initial retroreflectivity of  $150 \text{ mcd m}^{-2} \text{ lx}^{-1}$ .

Where striping joins existing striping, as shown on the plans, the Contractor shall begin and end the transition from the existing striping pattern into or from the new striping pattern a sufficient distance to ensure continuity of the striping pattern.

Thermoplastic traffic stripes shall be applied at the minimum thickness and application rate as specified below. The minimum application rate is based on a solid stripe of 4 inches in width.

Minimum Stripe Thickness (inch)	Minimum Application Rate (lb/ft)
0.098	0.34

Thermoplastic traffic stripes and pavement markings shall be free of runs, bubbles, craters, drag marks, stretch marks, and debris.

At the option of the Contractor, permanent traffic striping and pavement marking tape conforming to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions may be placed instead of the thermoplastic traffic stripes and pavement markings specified herein. Permanent tape, if used, shall be installed in conformance with the manufacturer's specifications.

If permanent tape is placed instead of thermoplastic traffic stripes and pavement markings, the tape will be measured and paid for by the linear foot as thermoplastic traffic stripe and by the square foot as thermoplastic pavement marking.

#### **10-1.126 PAINT TRAFFIC STRIPE AND PAVEMENT MARKING**

Painted traffic stripes (traffic lines) and pavement markings shall be applied in conformance with the provisions in Section 84, "Traffic Stripes and Pavement Markings," of the Standard Specifications and these special provisions.

Traffic stripe and pavement marking paint shall conform to the requirements in State Specification No. PTWB-01.

The color of the painted traffic stripes and pavement markings shall conform to the requirements in ASTM Designation: D 6628-01.

Retroreflectivity of the paint traffic stripes and pavement markings shall conform to the requirements in ASTM Designation: D 6359-99. White painted traffic stripes and pavement markings shall have a minimum initial retroreflectivity of  $250 \text{ mcd m}^{-2} \text{ lx}^{-1}$ . Yellow painted traffic stripes and pavement markings shall have a minimum initial retroreflectivity of  $150 \text{ mcd m}^{-2} \text{ lx}^{-1}$ .

At the option of the Contractor, permanent traffic striping and pavement marking tape conforming to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions may be placed instead of painted traffic stripes and pavement markings. Permanent tape, if used, shall be placed in conformance with the manufacturer's specifications.

If permanent tape is placed instead of painted traffic stripes and pavement markings, the tape will be measured and paid for by the linear foot as paint traffic stripe and by the square foot as paint pavement marking of the number of coats designated in the Engineer's Estimate.

#### **10-1.127 PAVEMENT MARKERS**

Pavement markers shall be placed in conformance with the provisions in Section 85, "Pavement Markers," of the Standard Specifications and these special provisions.

Attention is directed to "Traffic Control System For Lane Closure" of these special provisions regarding the use of moving lane closures during placement of pavement markers with bituminous adhesive.

The Contractor shall furnish the Engineer certificates of compliance for the pavement markers in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Retroreflective pavement markers shall be marked as abrasion resistant on the body of the markers.

### **SECTION 10-2 HIGHWAY PLANTING AND IRRIGATION SYSTEMS**

#### **10-2.01 GENERAL**

The work performed in connection with highway planting and irrigation systems shall conform to the provisions in Section 20, "Erosion Control and Highway Planting," of the Standard Specifications and these special provisions.

#### **COST BREAK-DOWN**

The Contractor shall furnish the Engineer a cost break-down for the contract lump sum items of highway planting and irrigation system. Cost break-down tables shall be submitted to the Engineer for approval within 15 working days after the contract has been approved. Cost break-down tables will be approved, in writing, by the Engineer before any partial payment will be made for the applicable items of highway planting and irrigation system involved.

Attention is directed to "Time-Related Overhead" of these special provisions regarding compensation for time-related overhead.

Cost break-downs shall be completed and furnished in the format shown in the samples of the cost break-downs included in this section. Line item descriptions of work shown in the samples are the minimum to be submitted. Additional line item descriptions of work may be designated by the Contractor. If the Contractor elects to designate additional line item descriptions of work, the quantity, value and amount for those line items shall be completed in the same manner as for the unit descriptions shown in the samples. The line items and quantities given in the samples are to show the manner of preparing the cost break-downs to be furnished by the Contractor.

The Contractor shall determine the quantities required to complete the work shown on the plans. The quantities and their values shall be included in the cost break-downs submitted to the Engineer for approval. The Contractor shall be responsible for the accuracy of the quantities and values used in the cost break-downs submitted for approval.

The sum of the amounts for the line items of work listed in each cost break-down table for highway planting and for irrigation system work shall be equal to the contract lump sum price bid for Highway Planting and Irrigation System, respectively. Overhead and profit, except for time-related overhead, shall be included in each individual line item of work listed in a cost break-down table.

No adjustment in compensation will be made in the contract lump sum prices paid for highway planting and irrigation system due to differences between the quantities shown in the cost break-downs furnished by the Contractor and the quantities required to complete the work as shown on the plans and as specified in these special provisions.

Individual line item values in the approved cost break-down tables will be used to determine partial payments during the progress of the work and as the basis for calculating an adjustment in compensation for the contract lump sum items of highway planting and irrigation system due to changes in line items of work ordered by the Engineer. When the total of ordered changes to line items of work increases or decreases the lump sum price bid for either Highway Planting or Irrigation System by more than 25 percent, the adjustment in compensation for the applicable lump sum item will be determined in the same manner specified for increases and decreases in the total pay quantity of an item of work in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications.

**HIGHWAY PLANTING COST BREAK-DOWN**

**Contract No. 07-202114**

UNIT DESCRIPTION	UNIT	APPROXIMATE QUANTITY	VALUE	AMOUNT
PLANT (GROUP B)	EA	45		
MULCH	CY	17,733		
COMMERCIAL FERTILIZER (SLOW RELEASE)	LB	23		
ROADSIDE CLEARING	LS	LUMP SUM		

**TOTAL** \_\_\_\_\_

**IRRIGATION SYSTEM COST BREAK-DOWN**

**Contract No. 07-202114**

UNIT DESCRIPTION	UNIT	APPROXIMATE QUANTITY	VALUE	AMOUNT
TEMPORARY IRRIGATION SYSTEM	LS	LUMP SUM		

**TOTAL** \_\_\_\_\_

**10-2.02 EXISTING HIGHWAY PLANTING**

In addition to the provisions in Section 20, "Erosion Control and Highway Planting," of the Standard Specifications, work performed in connection with existing highway planting shall conform to the provisions in "Existing Highway Facilities," of these special provisions.

**PRUNE EXISTING PLANTS**

Existing plants, as determined by the Engineer, shall be pruned. Pruning of the existing plants, except as otherwise provided in these special provisions, will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

**10-2.03 (BLANK)**

**10-2.04 HIGHWAY PLANTING**

The work performed in connection with highway planting shall conform to the provisions in Section 20-4, "Highway Planting," of the Standard Specifications and these special provisions.

**HIGHWAY PLANTING MATERIALS**

**Mulch**

Mulch must consist of either wood chips or tree bark or a combination of both.

**Commercial Fertilizer (Slow Release)**

Commercial fertilizer (slow release) shall be a pelleted or granular form, shall be slow or controlled release with a nutrient release over an 8-month to 12-month period, and shall fall within the following guaranteed chemical analysis range:

Ingredient	Percentage
Nitrogen	16-21
Phosphoric Acid	6-8
Water Soluble Potash	4-10

**ROADSIDE CLEARING**

Before preparing planting areas and mulch areas, trash and debris shall be removed from the entire highway right of way within the project limits as required under Construction Site Management of these special provisions.

The project area shall be cleared as specified herein:

- A. Weeds shall be killed and removed within proposed mulch areas and within the area extending beyond the outer limits of the proposed mulch areas to the adjacent edges of shoulders, dikes, curbs, sidewalks, walls, existing planting and fences. At those locations where proposed mulch areas are 12 feet or more from the adjacent edges of shoulders, dikes, curbs, sidewalks, walls, and fences, the clearing limit shall be 6 feet beyond the outer limits of the proposed mulch areas.
- B. Weeds shall be killed and removed from within areas where rock blankets are to be placed, and from within unpaved gore areas between the edge of pavement and planting areas as shown on the highway planting plans.
- C. Disposal of weeds killed during the initial roadside clearing will not be required, unless otherwise directed by the Engineer. When directed by the Engineer, killed weeds shall be disposed of and the disposal will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

After the initial roadside clearing is complete, additional roadside clearing work shall be performed as necessary to maintain the areas, as specified above, in a neat appearance until the start of the plant establishment period. This work shall include the following:

- A. Trash and debris shall be removed.
- B. Rodents shall be controlled.
- C. Weed growth shall be killed before the weeds reach the seed stage of growth or exceed 6 inches in length, whichever occurs first.
- D. Existing ground cover shall be killed and removed from within the 6-foot diameter areas specified for each proposed plant location within the existing ground cover areas.
- E. Weeds in plant basins, including basin walls, shall be removed by hand pulling, after the plants have been planted.

## **Weed Control**

Weed control shall also conform to the following:

- A. Stolon type weeds shall be killed with glyphosate.

Roadside clearing work shall not include work required to be performed as clearing and grubbing as specified in Section 16, "Clearing and Grubbing," of the Standard Specifications.

## **PESTICIDES**

Pesticides used to control weeds shall conform to the provisions in Section 20-4.026, "Pesticides," of the Standard Specifications. Except as otherwise provided in these special provisions, pesticide use shall be limited to the following materials:

- Cacodylic Acid
- Diquat
- Fluazifop-butyl
- Glyphosate
- Isoxaben (Preemergent)
- Sethoxydim
- Oxadiazon - 50 percent WP (Preemergent)
- Oryzalin (Preemergent)
- Pendimethalin (Preemergent)
- Prodiamine (Preemergent)
- Trifluralin (Preemergent)
- Napropamide (Preemergent)

Granular preemergents may be used when applied to areas that will be covered with mulch, excluding plant basins. Granular preemergents shall be limited to the following materials:

- Dichlobenil (Preemergent)
- Oxadiazon (Preemergent)

Granular preemergents shall be applied prior to the application of mulch. Mulch applications shall be completed in these areas on the same working day. Photosensitive dye will not be required.

Glyphosate shall be used to kill stolon type weeds.

Oxadiazon shall be of the emulsifiable concentration or wettable powder type, except when Oxadiazon is used under mulch in conformance with these special provisions.

A minimum of 100 days shall elapse between applications of preemergents.

Except for ground cover plants, preemergents shall not be applied within 18 inches of plants or within wild flower seeding areas.

Growth regulators shall not be applied within 6 feet of trees, shrubs or vines.

If the Contractor elects to request the use of other pesticides on this project, the request shall be submitted, in writing, to the Engineer not less than 15 days prior to the intended use of the other pesticides. Except for the pesticides listed in these special provisions, no pesticides shall be used or applied without prior written approval of the Engineer.

Pesticides shall not be applied within the limits of the plant basins. Pesticides shall not be applied in a manner that allows the pesticides to come in contact with the foliage and woody parts of the plants.

## **PLANTING**

Apply or place commercial fertilizer (slow release) at the time of planting and at the rates shown on the Plant List.

A granular preemergent must be applied to areas to be covered with mulch outside of plant basins.

Mulch placed in areas outside of plant basins shall be spread to a uniform depth.

Spread mulch from the outside of the proposed plant basin to the adjacent edges of shoulders, dikes, curbs, sidewalks, walls, fences, and existing plantings. If the proposed plant material is 12 feet or more from the adjacent edges of shoulders, dikes, curbs, sidewalks, walls, fences, and other existing plantings, the mulch must be spread 6 feet beyond the outside edge of the proposed plant basins.

## **PLANT ESTABLISHMENT WORK**

The plant establishment period shall be Type 2 and shall not be less than 180 working days.

Attention is directed to "Relief From Maintenance and Responsibility" in these special provisions regarding relief from maintenance and protection.

Weeds within plant basins, including basin walls and erosion control (Hydroseed) areas shall be controlled by hand pulling.

Weeds within mulched and outside of plant basins shall be controlled by killing.

At the option of the Contractor, plants of a larger container size than those originally specified may be used for replacement plants during the first 125 working days of the plant establishment period.

When ordered by the Engineer, one application of a preemergent pesticide conforming to the provisions in "Pesticides" of these special provisions, shall be applied between 40 working days and 50 working days prior to completion of the plant establishment period. This work will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

Wye strainers shall be cleaned at least 15 days prior to the completion of the plant establishment period.

The final inspection shall be performed in conformance with the provisions in Section 5-1.13, "Final Inspection," of the Standard Specifications and shall be completed a minimum of 20 working days before the estimated completion of the contract.

### **10-2.05 IRRIGATION SYSTEMS**

Irrigation systems shall be furnished and installed in conformance with the provisions in Section 20-5, "Irrigation Systems," of the Standard Specifications, except materials containing asbestos fibers shall not be used.

Method A pressure testing shall conform to the provisions in Section 20-5.03H(1), "Method A", of the Standard Specifications, except leaks that develop in the tested portion of the system shall be located and repaired after each test period when a drop of more than 5 pounds per square inch is indicated by the pressure gage. After the leaks have been repaired, the one hour pressure test shall be repeated and additional repairs made until the drop in pressure is 5 pounds per square inch or less.

#### **TEMPORARY IRRIGATION SYSTEM**

Attention is directed to "Section 20-4.06 WATERING" of the Standard Specifications regarding the Contractor's responsibility to furnish and apply water as required to keep the bioswale and GSRD shrubs in a healthy, growing condition during the life of the contract. No water is available at this project site. Water shall be furnished at the contractor's expense. At the Contractor's option, water may be applied by an irrigation system of the Contractor's design. The irrigation system shall be temporary. Materials for temporary irrigation system shall be of commercial quality. The Contractor shall submit written plans for the temporary irrigation system to the Engineer for approval not less than 5 days prior to beginning irrigation system work.

Prior to the end of the plant establishment period, the temporary irrigation system shall be removed and disposed of outside the highway right of way in accordance with the provisions in Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way," of the Standard Specifications.

Full compensation for temporary irrigation system shall be considered as included in the contract lump sum price paid for irrigation system and no separate compensation will be allowed therefor.

## **SECTION 10-3. ELECTRICAL SYSTEMS**

### **10-3.01 DESCRIPTION**

Modify traffic monitoring station, modify automatic vehicle classification station, modify ramp metering system, modify lighting and sign illumination, lighting (temporary), lighting (bikeway), communication system, changeable message sign (Location LB255) and (Location LB257), closed circuit television camera at various locations, video node (location LB237), data node (location LB237), traffic monitoring station at various locations, system testing and documentation, and maintaining existing traffic management system elements during construction shall conform to the provisions in Section 86, "Electrical Systems," of the Standard Specifications and these special provisions.

Lighting equipment is included in the following structures:

- A. Atlantic Boulevard Undercrossing (Bridge No. 53-1009) and (Bridge No. 53-67)
- B. Triggs Street Undercrossing (Bridge No. 53-0869)
- C. Northbound Route 710/Route 5 Separation (Bridge No. 53-0785R)
- D. Olympic Boulevard Undercrossing (Bridge No. 53-1044)
- E. Whittier Boulevard Undercrossing (Bridge No. 53-1150)
- F. Floral Drive Undercrossing (Bridge No. 53-1155)
- G. Southbound Route 710/Route 5 Separation (Bridge No. 53-0788L)
- H. Los Angeles River (Bridge No. 53-0828)

Communication conduit is included in the following structures:

- A. Los Angeles River Bridge (Bridge No. 53-0828)
- B. Atlantic Boulevard Undercrossing (Bridge No. 53-1009)
- C. Bandini Boulevard Undercrossing (Bridge No. 53-0877)
- D. Triggs Street Undercrossing (Bridge No. 53-0869)
- E. Northbound Route 710/Route 5 Separation (Bridge No. 53-0785R)
- F. Olympic Boulevard Undercrossing (Bridge No. 53-1044)
- G. Whittier Boulevard Undercrossing (Bridge No. 53-1150)
- H. Floral Drive Undercrossing (Bridge No. 53-1155)

Locations of closed circuit television camera, video node, data node, changeable message sign and traffic monitoring station installations are as followed:

- A. Closed circuit television camera (Location LB210), NB Route 710, South of Slauson Avenue, PM 21.0.
- B. Closed circuit television camera (Location LB219), SB Route 710, South of Bandini Boulevard, PM 21.9.
- C. Closed circuit television camera (Location LB231), SB Route 710, South of Triggs Street, PM 23.1.
- D. Closed circuit television camera (Location LB237), NB Route 710, South of Whittier Boulevard, PM 23.7.
- E. Closed circuit television camera (Location LB245), NB Route 710, South of Third Street, PM 24.5.
- F. Closed circuit television camera (Location LB257), NB Route 710, North of Floral Drive, PM 25.7.
- G. Video Node (Location LB237), NB Route 710, South of Whittier Boulevard, PM 23.7.
- H. Data Node (Location LB237), NB Route 710, South of Whittier Boulevard, PM 23.7.
- I. Changeable message sign system (Location LB255), SB Route 710, North of Floral Drive, PM 25.5.
- J. Changeable message sign system (Location LB257), NB Route 710, North of Floral Drive, PM 25.7.
- K. Traffic monitoring station (Location 2705), SB Route 710, North of Whittier Boulevard, PM 24.1.
- L. Traffic monitoring station (Location 2706), NB Route 710, North of Floral Drive, PM 25.9.
- M. Traffic monitoring station (Location 2305), NB Route 710, South of Ramona Boulevard, PM 26.4.

### **10-3.02 COST BREAK-DOWN**

Cost break-downs shall conform to the provisions in Section 86-1.03, "Cost Break-Down," of the Standard Specifications and these special provisions.

The Engineer shall be furnished a cost break-down for each contract lump sum item of work described in this Section 10-3.

The cost break-down shall be submitted to the Engineer for approval within 15 days after the contract has been approved. The cost break-down shall be approved, in writing, by the Engineer before any partial payment for the items of electrical work will be made.

The cost break-down shall include the following items in addition to those listed in the Standard Specifications:

- A. Piezoelectric axle sensor
- B. Screened transmission cable
- C. Epoxy grout
- D. Automatic vehicle classification unit
- E. Closed circuit television camera assembly
- F. Communication pull box
- G. Splice vault
- H. Video transmitter
- I. Video receiver
- J. Fiber optic traffic modem (FOTM)
- K. Fiber optic control modem (FOCM)
- L. Camera control modem (CCM)
- M. Fiber distribution unit (FDU)
- N. Video multiplexer
- O. Fiber optic cable
- P. Fiber optic splice closure
- Q. Model 334-TV controller cabinet
- R. Innerducts

### **10-3.03 MAINTAINING EXISTING AND TEMPORARY ELECTRICAL SYSTEMS**

Lighting and sign illumination system shutdowns shall be limited to periods allowed for lane closures listed or specified in "Maintaining Traffic" of these special provisions.

The contractor shall obtain written approval from the Engineer, not less than 72 hours prior to system cutover, testing, disconnection or disruption of service from existing lighting and sign illumination and ramp metering system.

No ramp metering controller shall be disconnected or disrupted between the hours of 6:00 a.m. and 9:00 a.m., and from 3:00 p.m. to 7:00 p.m., Monday through Friday.

No ramp metering controller shall be disconnected from its electrical power for more than 15 minutes in any 24-hour period without prior written approval from Engineer.

Replacement of existing magnetometers vehicle detectors damaged by the Contractor's operations, including traffic control, shall be performed at the Contractor's expense as directed by the Engineer and shall conform to the requirements in Section 86-5.01, "Vehicle Detectors" of the Standard Specifications.

### **10-3.04 LIGHTING (TEMPORARY)**

Temporary lighting system shall consist of installing, maintaining, and removing temporary lighting in conformance with the details shown on the plans.

The provisions in this section shall not relieve the Contractor from the responsibility to provide the additional devices or take the measures as may be necessary to conform to the provisions in Section 7-1.09, "Public Safety," of the Standard Specifications.

Other materials and equipment for a temporary lighting system including, but not limited to, mast arms, luminaires, wood poles, conductors, and hardware shall be furnished by the Contractor.

Materials and equipment to be used in the temporary lighting system shall be either new or used suitable for the intended use.

Unless otherwise directed by the Engineer, the system shall operate between 06:00 PM to 06:00 AM.

### **BONDING AND GROUNDING**

Luminaires and mast arms shall be mechanically and electrically secure to form a continuous system effectively grounded by the grounding conductor.

Generator neutral grounding shall conform to the provisions for multiple service points in Section 86-2.10, "Bonding and Grounding," of the Standard Specifications.

### **GENERATOR**

The Contractor shall provide portable generators for temporary lighting as shown on the plans.

Portable generators shall be 120-V or 120/240-V, 60 Hz, 2.5 kW minimum or shall be rated to provide power to temporary lighting, continuous duty type. Generators may be powered by gasoline, LPG or diesel engines operating at approximately 1800 revolutions per minute. Engines shall be provided with automatic oil feed. Generator systems shall be equipped to provide automatic start-stop operation, with a 12-V(dc) starting system. Generator output circuits shall have overcurrent protection with a maximum setting of 15 A.

Fuel storage shall be sufficient for periods of time during which the generator system will be operated unattended.

Engines shall be equipped with approved spark arresters.

Full compensation for portable generator shall be considered as included in the contract lump sum price paid for lighting (temporary) and no additional compensation will be allowed therefor.

### **GENERATOR OPERATION**

Two generators shall be provided. A single generator shall operate the system. In the event of a failure to supply voltage for the system, the second generator shall start automatically and transfer the system load upon reaching operating voltage.

### **10-3.05 MAINTAINING EXISTING TRAFFIC MANAGEMENT SYSTEM ELEMENTS DURING CONSTRUCTION**

Traffic Management System (TMS) elements include, but are not limited to ramp metering (RM) system, communication system, traffic monitoring stations, video image vehicle detection system (VIVDS), microwave vehicle detection system (MVDS), loop detection system, changeable message sign (CMS) system, extinguishable message sign (EMS) system, highway advisory radio (HAR) system, closed circuit television (CCTV) camera system, roadway weather information system (RWIS), visibility sensor, and fiber optic system.

Existing TMS elements, including detection systems, identified on the plans and located within the project limits shall remain in place and be protected from damage. If the construction activities require existing TMS elements to be nonoperational or off line, and if temporary or portable TMS elements are not shown on the plans, the Contractor shall provide for temporary or portable TMS elements. The Contractor shall receive the Engineer's approval on the type of temporary or portable TMS elements and installation method.

Before work is performed, the Engineer, the Contractor, and the Department's Traffic Operations Electrical representatives shall jointly conduct a pre-construction operational status check of all existing TMS elements and each element's communication status with the Traffic Management Center (TMC), including existing TMS elements that are not shown on the plans and elements that may not be impacted by the Contractor's activities. The Department's Traffic Operations Electrical representatives will certify the TMS elements' location and status, and provide a copy of the certified list of the existing TMS elements within the project limits to the Contractor. The status list will include the operational, defined as having full functionality, and the nonoperational components.

The Contractor shall obtain written approval from the Engineer at least 72 hours before interrupting existing TMS elements' communication with the TMC that will result in the elements being nonoperational or off line. The Contractor shall notify the Engineer at least 72 hours before starting excavation activities.

Traffic monitoring stations and their associated communication systems, which were verified to be operational during the pre-construction operational status check, shall remain operational on freeway/highway mainline at all times, except:

1. For a duration of up to 15 days on any continuous segment of the freeway/highway longer than 3 miles
2. For a duration of up to 60 days on any continuous segment of the freeway/highway shorter than 3 miles

If the construction activities require existing detection systems to be nonoperational or off line for a longer time period or the spacing between traffic monitoring stations is more than the specified criteria above, and temporary or portable detection operations are not shown on the plans, the Contractor shall provide provisions for temporary or portable detection operations. The Contractor shall receive the Engineer's approval on the type of detection and installation before installing the temporary or portable detection.

If existing TMS elements shown on the plans or identified during the pre-construction operational status check, except traffic monitoring stations, are damaged or fail due to the Contractor's activity, where the elements are not fully functional, the Engineer shall be notified immediately. If the Contractor is notified by the Engineer that existing TMS elements have been damaged, have failed or are not fully functional due to the Contractor's activity, the damaged or failed TMS elements, excluding structure-related elements, shall be repaired or replaced, at the Contractor's expense, within 24 hours. For a structure-related elements, the Contractor shall install temporary or portable TMS elements within 24 hours. For nonstructure-related TMS elements, the Engineer may approve temporary or portable TMS elements for use during the construction activities.

If fiber optic cables are damaged due to the Contractor's activities, the Contractor shall install new fiber optic cables from an original splice point or termination to an original splice point or termination, unless otherwise authorized in writing by the Engineer. Fiber optic cable shall be spliced at the splice vaults if available. The amount of new fiber optic cable slack in splice vaults and the number of new fiber optic cable splices shall be equivalent to the amount of slack and number of splices existing before the damage or as directed by the Engineer. Fusion splicing will be required.

The Contractor shall demonstrate that repaired or replaced elements operate in a manner equal to or better than the replaced equipment or as directed by the Engineer. If the Contractor fails to perform required repairs or replacement work, as determined by the Engineer, the State may perform the repair or replacement work and the cost will be deducted from monies due to the Contractor.

A TMS element shall be considered nonoperational or off line for the duration of time that active communications with the TMC is disrupted, resulting in messages and commands not transmitted from or to the TMS element.

The Contractor shall provide provisions for replacing existing TMS elements within the project limits, including detection systems, that were not identified on the plans or during the pre-construction operational status check that became damaged due to the Contractor's activities.

If the pre-construction operational status check identified existing TMS elements, then the Contractor, the Engineer, and the Department's Traffic Operations Electrical representatives shall jointly conduct a post construction operational status check of all existing TMS elements and each element's communication status with the TMC. The Department's Traffic Operations Electrical representatives will certify the TMS elements' status and provide a copy of the certified list of the existing TMS elements within the project limits to the Contractor. The status list will include the operational, defined as having full functionality, and the nonoperational components. TMS elements that cease to be functional between pre and post construction status checks shall be repaired at the Contractor's expense and as directed by the Engineer.

The Engineer will approve, in writing, the schedule for final replacement, the replacement methods and the replacement elements, including element types and installation methods before repair or replacement work is performed. The final TMS elements shall be new and of equal or better quality than the existing TMS elements.

## **PAYMENT**

The contract lump sum price paid for maintaining existing traffic management system elements during construction shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in maintaining existing traffic management system elements as shown on the plans, specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

If no electrical work exists on the project and no TMS elements are identified within the project limits, the pre-construction operational status check will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

Furnishing and installing temporary or portable TMS elements that are not shown on the plans, but are required when an existing TMS element becomes nonoperational or off line due to construction activities, will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

Furnishing and installing temporary or portable TMS elements and replacing TMS elements that are not shown on the plans nor identified during the pre-construction operational status check and were damaged by construction activities will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

If the Contractor is required to submit provisions for the replacement of TMS elements that were not identified, the provisions will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

### **10-3.06 CAST-IN-DRILLED-HOLE CONCRETE PILE FOUNDATIONS**

#### **GENERAL**

##### **Summary**

This work includes constructing cast-in-drilled-hole concrete pile foundations for traffic signal and lighting standards. Comply with Section 86-2.03, "Foundations," of the Standard Specifications, and "Piling" of these special provisions.

#### **MATERIALS**

Concrete must contain not less than 590 pounds of cementitious material per cubic yard.

#### **CONSTRUCTION**

For standards located in sidewalk areas, the pile foundation must be:

1. Placed to final sidewalk grade before the sidewalk is placed
2. Square for the top 4 inches

Use sleeve nuts on Type 1-A standards. The bottom of the base plate must be flush with finished grade.

#### **PAYMENT**

Payment for cast-in-drilled-hole concrete pile foundations shall conform to the provisions in Section 86-8, "Payment," of the Standard Specifications.

### **10-3.07 STANDARDS, STEEL PEDESTALS, AND POSTS**

Standards, steel pedestals, and posts for traffic signal and lighting and closed circuit television standards shall conform to the provisions in Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications, "Steel Structures" of these special provisions, and the following requirements.

Steel bolts not designated on the plans as high-strength (HS) or stainless steel shall be for general applications and shall conform to the requirements in ASTM Designation: A 307.

Anchor bolts shall conform to the requirements in ASTM Designation: F 1554, Grade 36. High-strength (HS) anchor bolts shall conform to the requirements in ASTM Designation: F 1554, Grade 105.

Handhole reinforcement rings for standards, steel pedestals, and posts shall be continuous around the handholes.

Type 1 standards shall be assembled and set with the handhole on the downstream side of the pole in relation to traffic or as shown on the plans.

### **10-3.08 CONDUIT**

Conduit to be installed underground shall be Type 1, Type 3, or Type 4 unless otherwise specified.

The conduit in a foundation and between a foundation and the nearest pull box shall be Type 1.

When a standard coupling cannot be used for joining Type 1 conduit, a UL-listed threaded union coupling conforming to the provisions in Section 86-2.05C, "Installation," of the Standard Specifications.

Conduit runs shown on the plans to be located behind curbs may be installed in the street, within 3 feet of, and parallel with the face of the curb, by the trenching in pavement method in conformance with the provisions in Section 86-2.05C, "Installation," of the Standard Specifications. Pull boxes shall be located behind the curb or at the locations shown on the plans.

After conductors have been installed, the ends of conduits terminating in pull boxes, splice vaults, service equipment enclosures, and controller cabinets shall be sealed with an approved type of sealing compound.

### **10-3.09 PULL BOXES**

Grout shall not be placed in the bottom of pull boxes, except communication pull boxes.

Pull boxes that are the traffic rated type, 5(T) or 6(T), except pull boxes in concrete barriers must have tamper proof bolts to secure the cover/metal lid to the box. Tamper proof bolts must be approved by the Engineer before ordering and installing.

No. 9 pull boxes must have tamper proof bolts to secure the metal lid to the box.

The size and the length of the tamper proof are similar to the hold down bolts as shown on the plans.

Submit an equipment and material list under Section 86-1.04, "Equipment List and Drawings," of the Standard Specifications. List must include factory-tested requirements for the fittings, screws and fastener strengths.

Tamper proof materials used must:

1. Be appropriate and compatible to the pull box type shown on plans.
2. Maintain:
  - 2.1. Materials associated with the pull box intact
  - 2.2. Dimensions of the pull box
  - 2.3. Sufficient space for conduit and conductors inside pull boxes
3. Resist unauthorized removal of wires from the pull box
4. Not interfere with ADA requirements

Tamper proof bolts must have a written warranty from the manufacturers against defects in material and workmanship.

### **10-3.10 CONDUCTORS, CABLES, AND WIRING**

Splices shall be insulated by "Method B."

Conductors shall be secured to the projecting end of conduit in pull boxes to prevent pulling.

### **10-3.11 SERVICE**

Continuous welding of exterior seams in service equipment enclosures is not required.

Circuit breakers shall be plug-in type and shall be mounted horizontally.

Circuits with Model 500 changeable message signs shall have service equipment enclosures which have main busses and terminal lugs rated for 200 A, minimum, and a No. 2 bare copper ground wire.

Each service shall be provided with up to 2 main circuit breakers which shall disconnect ungrounded service entrance conductors. Where the "Main" circuit breaker consists of 2 circuit breakers as shown on the plans or required in the special provisions, each of the circuit breakers shall have a minimum interrupting capacity of 10,000 A, rms.

An engraved phenolic nameplate must be installed with stainless steel rivets on the exterior of front panels indicating the identification number and service address of the service equipment enclosure. Character size must be a minimum of 0.2 inch in height.

Service conduit between the serving utility owned power pole and service equipment enclosure must not be installed until service location has been verified by the serving utility.

Where new service is to be installed, the Contractor must notify the Engineer in writing at least 5 working days prior to the date service is required.

### **10-3.12 NUMBERING ELECTRICAL EQUIPMENT**

Self-adhesive retroreflective numbers and edge sealer shall be Contractor-furnished.

The numbers and edge sealer shall be placed on the equipment where designated by the Engineer.

Retroreflective numbers shall be applied to a clean surface. Only the edges of the numbers shall be treated with edge sealer.

Five-digit, self-adhesive equipment numbers shall be placed for all electroliers, soffit lighting, sign lighting, and service pedestals. On service pedestals, the numbers shall be placed on the front door. On electroliers, the numbers shall be placed 10 feet from the base of electrolier, as shown on the plans and as directed by the Engineer.

Numbers for illuminated signs mounted on overcrossings or for soffit luminaires shall be placed on the nearest adjacent bent or abutment at approximately the same station as the sign or soffit luminaire. Where no bent or abutment exists near the sign or soffit luminaire, the number shall be placed on the underside of the structure adjacent to the sign or soffit luminaire. Arrangement of numbers shall be the same as those used for electroliers.

Adhesive numbers for all locations except wood poles must be white reflective adhesive sheeting, 3 inches in width, with 3 inches, Black Series D letters and numbers. The letters and numbers may be screened on to the reflective sheeting or may be die cut and adhesively attached. Labels for each location may be individual characters applied or a continuous strip applied. Reflective sheeting, numbers and letters must comply with the respective specifications in the Department of Transportation publication, "Specifications for Aluminum Reflective Sheeting Signs."

Full compensation for retroreflective numbers and edge sealers are included in the contract lump sum price paid for modify lighting and sign illumination and for the various items of work involved and no additional compensation will be allowed therefor.

### **10-3.13 STATE-FURNISHED CONTROLLER ASSEMBLIES**

The Model 170 controller assemblies, excluding anchor bolts, will be State-furnished as provided under "Materials" of these special provisions.

The Contractor shall construct each controller cabinet foundation as shown on the plans for Model 334 cabinets (including furnishing and installing anchor bolts), shall install the controller cabinet on the foundation, and shall make field wiring connections to the terminal blocks in the controller cabinet.

A listing of field conductor terminations, in each State-furnished controller cabinet, will be furnished free of charge to the Contractor at the site of the work.

State forces will maintain controller assemblies. The Contractor's responsibility for controller assemblies shall be limited to conforming to the provisions in Section 6-1.02, "State-Furnished Materials," of the Standard Specifications.

### **10-3.14 LIGHT EMITTING DIODE SIGNAL MODULE**

#### **GENERAL**

##### **Summary**

This work includes installing LED signal module. Comply with Section 86, "Electrical Systems," of the Standard Specifications.

Use LED signal module as the light source for the following traffic signal faces:

1. 12-inch section

##### **Submittals**

Before shipping LED signal modules to job site, submit the following to the Transportation Laboratory:

1. Delivery form including district number, EA, and contact information
2. List containing all LED signal module serial numbers anticipated for use
3. LED signal modules

##### **Quality Control and Assurance**

Module must be one listed on the Pre-Qualified Products List for LED traffic signals at:

[http://www.dot.ca.gov/hq/esc/approved\\_products\\_list](http://www.dot.ca.gov/hq/esc/approved_products_list)

The State will test LED signal module shipments as specified in ANSI/ASQ Z1.4. Testing will be completed within 30 days of delivery to the Transportation Laboratory. LED signal modules tested or submitted for testing must be representative of typical production units. LED and circular LED signal modules will be tested as specified in California Test 604. All parameters of the specification may be tested on the modules. LEDs must be spread evenly across the module. LED arrow indication must provide the minimum initial luminous intensity listed. Measurements will be performed at the rated operating voltage of 120 V(ac).

Delays resulting from submittal of non-compliant materials do not relieve you from executing the contract within the allotted time. Non-compliant materials will be rejected. You must resubmit new LED for retesting and pick up the failed units within 7 days of notification. You must provide new LED signal modules and allow a minimum of 30 days for the retest. You must pay for all shipping and handling costs related to testing and retesting. Delays resulting from resubmittal and retesting are your responsibility and no extra time will be allowed.

After testing, you must pick up the tested LED signal modules from the Transportation Laboratory and deliver to the job site.

## Warranty

The manufacturer must provide a written warranty against defects in materials and workmanship for LED signal modules for a minimum period of 48 months after installation of LED signal modules. Replacement LED signal modules must be provided within 15 days after receipt of failed LED modules at your expense. The State pays for shipping the failed modules to you. All warranty documentation must be submitted to the Engineer before installation. Replacement LED signal modules must be delivered to State Maintenance Electrical Shop at 524 S Flower Street, Burbank, CA 91504.

## MATERIALS

Minimum power consumption for LED signal module must be 5 W.

LED signal module must have an operational lifecycle rating of 48 months. During the operational lifecycle, LED signal module must meet all parameters of this specification.

LED signal module must be designed for installation in the door frame of standard traffic signal housing.

LED signal module must:

1. Be 4 pounds maximum weight
2. Be manufactured for 12-inch circular
3. Be from the same manufacturer
4. Be the same model for each size
5. Be sealed units with:
  - 5.1. 2 color-coded conductors for power connection, except for lane control LED signal modules use 3 color-coded conductors.
  - 5.2. Printed circuit board and power supply contained inside and complying with Chapter 1, Section 6 of TEES published by the Department.
  - 5.3. Lens that is:
    - 5.3.1. Integral to the units
    - 5.3.2. Convex or flat with a smooth outer surface
    - 5.3.3. Made of UV stabilized plastic or glass, and withstands UV exposure from direct sunlight for 48 months without exhibiting evidence of deterioration
  - 5.4. 1-piece EPDM gasket
6. Include 3-foot long conductors with quick disconnect terminals attached
7. Be sealed in door frames
8. Fit into existing traffic signal section housing and comply with ITE publication, Equipment and Material Standards, Chapter 2, "Vehicle Traffic Control Signal Heads"

Individual LEDs must be wired so catastrophic loss or failure of 1 LED will not result in loss of more than 5 percent of the signal module light output. Failure of an individual LED in a string must not result in loss of entire string or other indication.

No special tools for installation are allowed.

LED signal module must:

1. Be weather tight and connect directly to electrical wiring.
2. Be capable of optical unit replacement.
3. Be a single, self-contained device, ready for installation into traffic signal housing.
4. Have manufacturer's name, trademark, model number, serial number, lot number, month and year of manufacture, and required operating characteristics, including rated voltage, power consumption, and volt-ampere, permanently marked on the back of the module.
5. Have a symbol of module type and color. Symbol must be an inch in diameter. Color must be written out in 0.50 inch high letters next to the symbol.
6. Be AllnGaP technology for red and yellow indications and gallium nitride technology for green indications.
7. Be ultra bright type rated for 100,000 hours of continuous operation from -40 to +74 °C.
8. Have a maximum power consumption as follows:

**Power Consumption Requirements**

LED Signal Module Type	Power Consumption (Watts)					
	Red		Yellow		Green	
	25 °C	74 °C	25 °C	74 °C	25 °C	74 °C
12-inch circular	11	17	22	25	15	15

Lens may be tinted, or may use transparent film or materials with similar characteristics to enhance "ON/OFF" contrasts. Tinting or other materials to enhance "ON/OFF" contrast must not affect chromaticity and must be uniform across the face of the lens.

If polymeric lens is used, surface coating or chemical surface treatment must be applied for front surface abrasion resistance.

Power supply must be integral to the module.

Internal components must be adequately supported to withstand mechanical shock and vibration from high winds and other sources.

Lens and LED signal module material must comply with the ASTM specifications for that material.

Enclosures containing either the power supply or electronic components of LED signal module, except lenses, must be made of UL94VO flame-retardant material.

If a specific mounting orientation is required, the LED signal module must have prominent and permanent vertical markings for accurate indexing and orientation within the signal housing. Markings must include an up arrow, or the word "UP" or "TOP."

LED signal module must meet or exceed the following values when operating at 25 °C:

**Minimum Initial Intensities for Circular Indications (cd)**

Angle (v,h)	12-inch		
	Red	Yellow	Green
2.5, ±2.5	399	798	798
2.5, ±7.5	295	589	589
2.5, ±12.5	166	333	333
2.5, ±17.5	90	181	181
7.5, ±2.5	266	532	532
7.5, ±7.5	238	475	475
7.5, ±12.5	171	342	342
7.5, ±17.5	105	209	209
7.5, ±22.5	45	90	90
7.5, ±27.5	19	38	38
12.5, ±2.5	59	119	119
12.5, ±7.5	57	114	114
12.5, ±12.5	52	105	105
12.5, ±17.5	40	81	81
12.5, ±22.5	26	52	52
12.5, ±27.5	19	38	38
17.5, ±2.5	26	52	52
17.5, ±7.5	26	52	52
17.5, ±12.5	26	52	52
17.5, ±17.5	26	52	52
17.5, ±22.5	24	48	48
17.5, ±27.5	19	38	38

LED signal module must meet or exceed the following illumination values for 48 months when operating over a temperature range of -40 to + 74 °C. Yellow LED signal module must meet or exceed the following illumination values for 48 months, when operating at 25 °C:

**Minimum Maintained Intensities for Circular Indications (cd)**

Angle (v,h)	12-inch		
	Red	Yellow	Green
2.5, ±2.5	339	678	678
2.5, ±7.5	251	501	501
2.5, ±12.5	141	283	283
2.5, ±17.5	77	154	154
7.5, ±2.5	226	452	452
7.5, ±7.5	202	404	404
7.5, ±12.5	145	291	291
7.5, ±17.5	89	178	178
7.5, ±22.5	38	77	77
7.5, ±27.5	16	32	32
12.5, ±2.5	50	101	101
12.5, ±7.5	48	97	97
12.5, ±12.5	44	89	89
12.5, ±17.5	34	69	69
12.5, ±22.5	22	44	44
12.5, ±27.5	16	32	32
17.5, ±2.5	22	44	44
17.5, ±7.5	22	44	44
17.5, ±12.5	22	44	44
17.5, ±17.5	22	44	44
17.5, ±22.5	20	41	41
17.5, ±27.5	16	32	32

LED signal module must comply with the following chromaticity requirements for 48 months when operating over a temperature range of -40 to +74 °C.

**Chromaticity Standards (CIE Chart)**

Red	Y: not greater than 0.308, or less than 0.998 - x
Yellow	Y: not less than 0.411, nor less than 0.995 - x, nor greater than 0.452
Green	Y: not less than 0.506 - 0.519x, nor less than 0.150 + 1.068x, nor more than 0.730 - x

LED signal module must operate:

1. At a frequency of 60 ± 3 Hz, over a voltage range from 95 to 135 V(ac), without perceptible flicker to the unaided eye. Fluctuations of line voltage must have no visible effect on luminous intensity of the indications. Rated voltage for measurements must be 120 V(ac).
2. Compatible with currently used controller assemblies, including solid state load switches, flashers, and conflict monitors. Comply with TEES Chapters 3 and 6. If a 20 mA alternating current or less is applied to the unit, the voltage read across the 2 leads must be 15 V(ac) or less.

Wiring and terminal block must comply with Section 13.02 of ITE publication, Equipment and Material Standards, Chapter 2, "Vehicle Traffic Control Signal Heads." Electrical connection for each Type 1 LED signal module must be 2 secured, color-coded, 3-foot long, 600 V(ac), 20 AWG minimum stranded jacketed copper wires. Wires must comply with NEC, rated for service at +105 °C.

LED signal module on-board circuitry must:

1. Include voltage surge protection to withstand high-repetition noise transients. The voltage surge protection must comply with NEMA Standard TS2, Section 2.1.6.
2. Comply with FCC, Title 47, SubPart B, Section 15 regulations for Class A emission limits for electronic noise.

LED signal module must provide a power factor of 0.90 or greater.

Total harmonic distortion from current and voltage induced into an alternating current power line by LED signal module must not exceed 20 percent at an operating temperature of 25 °C.

When power is applied to LED signal module, light emission must occur within 90 ms.

### **10-3.15 DETECTORS**

Loop detector sensor units will be State-furnished in conformance with the provisions in "Materials" of these special provisions.

Loop detector lead-in cable shall be Type B.

For Type E detector loops, sides of the slot shall be vertical and the minimum radius of the slot entering and leaving the circular part of the loop shall be 1-1/2 inches. Slot width shall be a maximum of 5/8 inch. Loop wire for circular loops shall be Type 2. Slots of circular loops shall be filled with elastomeric sealant or hot melt rubberized asphalt sealant.

The depth of loop sealant above the top of the uppermost loop wire in the sawed slots shall be 2 inches, minimum.

Slots in portland cement concrete shall be filled with elastomeric sealant or hot-melt rubberized asphalt sealant, or shall be filled with an epoxy sealant conforming to the provisions in Section 95-2.09, "Epoxy Sealant for Inductive Loops," of the Standard Specifications.

### **10-3.16 MODIFY AUTOMATIC VEHICLE CLASSIFICATION STATION**

Modify Automatic vehicle classification (AVC) station consists of relocating Model 334 controller cabinet, installing inductive loop detectors, pull boxes, conduits, conductors, automatic vehicle classifier, piezoelectric axle sensors, and epoxy grout for axle sensors.

Make field wiring connections to the terminal blocks in controller cabinets.

Deliver the automatic vehicle classification unit, piezoelectric axle sensors and epoxy grout to the Caltrans District 7 Traffic Monitoring, 604 S Flower Street, Burbank, CA 91502, telephone No. (323) 849-5028 for certification and testing at least 10 working days prior to installation.

### **INDUCTIVE LOOP DETECTORS**

Inductive loop detectors for AVC station and installation must conform to the requirements in "Detectors" of these special provisions.

### **PIEZOELECTRIC AXLE SENSORS**

Piezoelectric axle sensors must be Class II and used for vehicle classification purposes. Piezoelectric axle sensors must consist of a piezoelectric copolymer surrounded by a 1/4" wide x 1/16" thick outer brass sheath. Sensors must be 6 feet in length and come with a minimum 200 feet of screened transmission cable (STC) attached and length adequate to reach the cabinet with no splicing. The sensors must be installed in an array of one inductive loop detector and 2 axle sensors per lane. The Engineer will determine the exact location of the inductive loop detector and piezoelectric axle sensor arrays.

Sawed pavement slots containing STC must be filled with epoxy grout conforming to Section 95-2.09, "Epoxy Sealant for Inductive Loops," of the Standard Specifications.

Epoxy grout components must be in temperature range from 68 to 77 °F before mixing.

Sawed pavement channels must be between the temperature range from 68 to 104 °F before epoxy grout is poured, and be maintained between the temperature range from 68 to 122 °F during curing.

When pavement temperature is below the listed values, a fan-forced portable heater or similar device must be used to heat the channel before grout is poured. Pavement around channels may be heated after sensors are installed. Axle sensors or epoxy grout must not be scorched.

### **SCREENED TRANSMISSION CABLE**

Screened transmission cable (STC) must be RG-58C/U coaxial cable rated for direct burial. Screened transmission cable runs must be maintained at a minimum length of 200 feet and length adequate to reach the cabinet with no splicing.

Splices in STC run must be made in the first pull box on outside shoulders.

### **EPOXY GROUT**

Epoxy grout must consist of a two component, self-leveling 100 percent solid polyurea.

### **AUTOMATIC VEHICLE CLASSIFICATION UNIT**

Automatic vehicle classification unit must consist of a rack mounted traffic counter/classifier capable of classifying a minimum of 16 lanes using a piezo-loop-piezo configuration in each lane.

The unit must have the following basic characteristics:

1. AC powered with battery backup.
2. Solid state construction.
3. The unit must perform over a temperature range of -40 to +158 °F.
4. Internal clock must have continuous date (corrected for leap years) and time (24 hour) with accuracy of ± 2 minutes per month. Clock must keep the correct time when the backup battery is completely discharged.
5. Piezoelectric axle sensor separation must be a user-programmable parameter by lane.
6. The unit must perform a minimum of 3 types of data collection simultaneously; i.e. vehicle classification count, speed count and total vehicle count. A separate file must be output for each study.
7. The device must be internally protected from reverse polarity of the battery or external power supply.
8. Data stored in memory must not be lost when the backup battery of the unit is completely discharged or disconnected.
9. The maximum vehicle density of the unit must be at least 3 vehicles per lane per second.
10. The operating speed range of the unit must be at least from 5 to 120 miles per hour.
11. The unit must be able to detect, count, measure speed and classify at least 9,999 vehicles per lane per hour.
12. The internal memory of the unit must be capable of storing a minimum of 45 days of data in hourly intervals or bins. For example, the unit must be able to store summary counts for each of 15 vehicle classifications, in hourly intervals, for 16 lanes for 45 days.
13. The unit must be able to display data in a per-vehicle format as the data is collected.
14. The unit must be able to connect directly with a laptop computer for programming, monitoring and data retrieval in the field.
15. The unit must be able to connect by telemetry via an external modem for programming, monitoring and data retrieval from a host computer in the central office.

The unit must meet the following accuracy standards:

1. Traffic volumes: ±3 percent with a 95 percent accuracy
2. Axle spacing: +4 inches (with good lane discipline)
3. Speed: +1 mile per hour

The modem must be an AC powered CDMA cellular modem compatible with the automatic vehicle classification unit. An external antenna with sufficient decibel gain to ensure consistent, stable connections must be mounted on the exterior of controller cabinet.

You must supply necessary cables and accessories to connect the automatic vehicle classification unit to the piezo-electric axle sensors, loop detectors and modem.

### **ACCEPTANCE TESTING**

You must demonstrate that the automatic vehicle classification system is available for use by the Department of Transportation by successfully completing the acceptance test for each lane of data collection.

The acceptance test must consist of the following:

1. Loop detectors must be tested according to the procedure in Section 86-2.14B, "Field Testing," of the Standard Specifications.
2. Piezoelectric axle sensors must be tested as follows:
  - 2.1. Capacitance must be 20 percent of the sensor's data sheet as provided by the manufacturer.
  - 2.2. Dissipation factor must be less than 0.04 when measured in the 20 nF range.
  - 2.3. Resistance must be greater than 20 Megohms.
3. A minimum of 100 per-vehicle records must be collected for each lane. Collected data must meet the following accuracy standards:
  - 3.1. Total volume. ±3 percent with 95 percent accuracy
  - 3.2. Vehicle classification. 95 percent accurate classification by type.
4. Correct functioning of the communications link must be verified by collecting data files from the on-site equipment with the central office host computer located at Caltrans Distric 7 Traffic Monitoring Field Office, 620 S Flower St., Burbank, CA 91502.

5. Continuous operation of the automatic vehicle classification system on-site equipment for 5 consecutive days. Failure of the system to record and store data meeting the requirements set forth in these special provisions for an accumulated time exceeding 3 hours during the 5-day period must be cause for the acceptance test to be rejected and repeated.
6. Testing of the automatic vehicle classification system software during the 5-day period and the full working day following the 5-day period. Failure of the software to perform any application required in these special provisions must be cause for the acceptance test to be rejected and repeated.

Unavailability must be the failure of the system to pass the acceptance test. You must demonstrate to the satisfaction of the Engineer that the failure is not caused by your furnished equipment.

### 10-1.17 LIGHT EMITTING DIODE LUMINAIRE

#### GENERAL

##### Definitions

**CALiPER:** Commercially Available light emitting diode (LED) Product Evaluation and Reporting. A US DOE program for the testing and monitoring of commercially available LED luminaires and lights.

**Correlated color temperature:** The absolute temperature (in Kelvin) of a blackbody whose chromaticity most nearly resembles that of the light source.

**Footcandle:** Unit of illuminance; a measurement of light.

**House luminaire side:** lumens from luminaire directed to light up areas between fixture and the pole: e.g. as sidewalks at intersection, or areas off of the shoulders on freeways

**IP:** International Protection rating, sometimes referred to as ingress protection, that delineates the level at which foreign objects and water can intrude inside a device.

**L70:** The extrapolated life in hours of the luminaire when the luminous output depreciates 30 percent from initial values.

**NVLAP:** National Voluntary Laboratory Accreditation Program under the US DOE to accredit independent testing laboratories to qualify.

**Power factor:** Ratio of the real power component to the total, complex, power component.

**Street luminaire side:** lumens from luminaire directed to light up areas between fixture and the roadway: e.g. the traveled ways, freeway lanes.

**Surge protection device:** A subsystem or component that can protect the unit against short duration voltage and current surges.

**Total harmonic distortion:** The ratio of the root-mean-square (rms) value of the sum of the squared individual harmonic amplitudes to the rms value of the fundamental; frequency of a complex waveform.

**Transportation Electrical Equipment Specifications:** A package of standard specifications for transportation related electrical equipment to be used on State Highways. This document is compiled by the Department.

##### Submittals

Submit test units to the Department after the manufacturer's testing is completed. Include the manufacturer's testing data. Product submittals must be accompanied by:

1. Product specification sheets or other documentation that includes the designed parameters as detailed in the specification. The parameters include:
  - 1.1. Maximum power in watts
  - 1.2. Maximum designed junction temperature
  - 1.3. Heat sink area in square inches
  - 1.4. Designed junction to ambient thermal resistance calculation with thermal resistance components clearly defined
  - 1.5. L70 in hours when extrapolated for the average nighttime operating temperature
2. IES LM-79 and IES LM-80 compliant test reports from a CALiPER-qualified or NVLAP-approved testing laboratory for the specific model submitted.
3. Initial and depreciated isofootcandle charts showing the specified minimum illuminance curve for that particular application. The charts must be calibrated to feet and show a 40 by 40 foot grid. The depreciated isofootcandle curve must be calculated at the minimum operational life.
4. Test report showing surge protection device (SPD) performance as tested under ANSI/IEEE C62.41.2 and ANSI/IEEE C62.45.
5. Test report showing mechanical vibration test results as tested under California Test 611.

## Quality Control and Assurance

The luminaires must be manufactured under the manufacturer's quality assurance program. The program must include (1) production quality assurance and (2) design quality assurance.

Production quality assurance must include statistically-controlled routine tests to ensure minimum performance levels of the modules built to meet this specification and a documented process for resolving problems. The process and test results documentation must be kept on file for a minimum of 7 years.

Design quality assurance must be performed by the manufacturer or an independent testing lab hired by the manufacturer on new luminaire designs and when a major design change is implemented on an existing design. A major design change is defined as a design change, electrical or physical, that (1) changes the performance characteristics of the luminaire, (2) results in a different circuit configuration for the power supply, or (3) changes the layout of the individual LEDs in the module. Submit 2 units for each design for design qualification testing.

The sample luminaires must be energized for a minimum of 24 hours, at 100 percent on-time duty cycle, at a temperature of +70 °F before performing design qualification testing.

Failure of the luminaire that renders the unit non-compliant with the specification after burn in must be rejected.

The luminaire must be tested under California Test No. 678 and as specified. Luminaire performance must be judged against the specified minimum illuminance in the specified pattern for a particular application. The luminaire lighting performance must be adjusted, depreciated, for the minimum operating life by using the LED manufacturer's data or the data from the LM-80 test report, whichever results in a higher level of lumen depreciation.

The luminaire is compliant photometrically. If the initial minimum illuminance level is achieved in 100 percent of the area of the specified lighting pattern and the depreciated minimum illuminance is maintained in at least 95 percent of the area of the specified lighting pattern, then minimum length of the depreciated isofootcandle curve is equal or greater than the length of the specified isofootcandle curve.

The Department may perform random sample testing on shipments. Testing will be completed within 30 days after delivery to the Transportation Laboratory. Parameters of the specification may be tested on the shipment sample.

## Warranty

The manufacturer must provide a written warranty for the performance of the luminaire and against defects in materials and workmanship for the luminaires for 84 months after acceptance of the luminaires. Replacement luminaires must be provided promptly after receipt of failed luminaires at your expense. The State pays for shipping the failed luminaires to you. Warranty documentation must be submitted to the Transportation Laboratory before random sample testing. Deliver replacement luminaires to State Maintenance Electrical Shop at 524 S Flower Street, Burbank, CA 91504.

## MATERIALS

### General

The luminaire consists of an assembly that uses LEDs as the light source. In addition, a complete luminaire consists of a housing, an LED array, and an electronic driver (power supply). The luminaire must comply with the following requirements:

1. UL listed under UL 1598 for luminaires or an equivalent
2. Have a minimum operational life is 63,000 hours
3. Expected to operate at an average operating time of 11.5 hours per night
4. Designed to operate at an average nighttime operating temperature of 70 °F
5. Have an operating temperature range from -40 to +130 °F
6. Expected to operate above 100 °F, but not expected to comply with photometric requirements
7. Defined by the following application:

Application	Equivalent LED replacement for
Roadway 1	200 Watt HPS mounted at 34 ft
Roadway 2	310 Watt HPS mounted at 40 ft

The individual LEDs must be connected such that a catastrophic loss or a failure of one LED will not result in the loss of the entire luminaire.

The housing must be fabricated from materials that are designed to withstand a 3000-hour salt spray test under ASTM B 117. Each refractor or lens must be made from UV-inhibited high impact plastic such as acrylic or polycarbonate and be resistant to scratching. Polymeric materials of enclosures containing either the power supply or electronic components of the luminaire must be made of UL94VO flame retardant materials. The lenses of the luminaire are excluded from this requirement. Paint or powder coating of the housing must comply with Section 86, "Electrical Systems," of the Standard Specifications.

**Luminaire Identification**

Each luminaire must have the following identification permanently marked inside the unit and outside of its packaging box:

1. Manufacturer's name
2. Trademark
3. Model number
4. Serial number
5. Date of manufacture (month-year)
6. Lot number

The rated voltage, watts and rated power in volt-ampere must be permanently marked inside each unit.

**Electrical**

The luminaire must operate from a 60 ±3 Hz AC line over a voltage ranging from 95 to 250 V(ac). The fluctuations of line voltage must have no visible effect on the luminous output. The standard operating voltages are 120 and 240 V(ac). The power factor of the luminaire must be 0.90 or greater. Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire must not exceed 20 percent. The maximum power consumption allowed for the luminaire depends on the application and is as shown in the following table:

Application	Maximum Wattage
Roadway 1	165
Roadway 2	235

**Surge Suppression and Electromagnetic Interference**

The luminaire on-board circuitry must include an SPD to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes, and other interference. The SPD must protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C64.41.2 (Tables 1 and 4) for Location Category C-High. SPD must conform to UL 1449 or UL 1283, depending of the components used in the design. SPD performance must be tested under ANSI/IEEE C62.41.45 based on ANSI/IEEE C62.41.2 definitions for standard and optional waveforms for Location Category C-High. The luminaires and associated on-board circuitry must meet Class A emission limits under FCC Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise.

**Compatibility**

The luminaire must be operationally compatible with currently used lighting control systems and photoelectric controls.

**Photometric Requirements**

The illuminance must not decrease by more than 30 percent over the minimum operating life or L70 must be at least the minimum operating life. The measurements must be calibrated to standard photopic calibrations. The minimum maintained illuminance is listed in the table below and is measured as a point:

Application	Roadway 1	Roadway 2
Mounting Height (ft)	34	40
Minimum Maintained Illuminance (fc)	0.15	0.20
Isofootcandle Curve	Pattern defined by ellipse with equation : $(x^2/6724)+(y-20)^2/2756.25=1$ x direction is longitudinal along the roadway, y direction is transverse to roadway, luminaire is offset from center of pattern by 20 feet to the "house luminaire side" of pattern.	Same

The luminaire must have a correlated color temperature range of 4,000 to 6,500K. The color rendering index must be 70 or greater.

The luminaire must not allow more than:

1. 10 percent of the rated lumens to project above 80 degrees from vertical
2. 2.5 percent of the rated lumens to project above 90 degrees from vertical

### Thermal Management

The thermal management of the heat generated by the LEDs must be of sufficient capacity to assure proper operation of the luminaire over the minimum operation life. The LED manufacturer's maximum junction temperature for the minimum operation life must not be exceeded. The maximum allowed junction temperature is 221 °F.

The junction-to-ambient thermal resistance must be 95 °F per Watt or less. Thermal management must be passive by design. The use of fans or other mechanical devices is not allowed. The minimum heat sink surface area is 3.5 square inch per Watt. The heat sink material must be aluminum or other material of equal or lower thermal resistance.

The luminaire must contain circuitry that will automatically reduce the power to the LEDs to 50 percent of normal operating power or to a level that will insure the maximum junction temperature is not exceeded, when the ambient outside air temperature is 100 °F.

### Physical and Mechanical Requirements

The luminaire must be a single, self-contained device, not requiring on-site assembly for installation. The power supply for the luminaire is integral to the unit. The maximum weight of the luminaire must be 35 lbs. The maximum effective projected area when viewed from either side or either end must be 1.4 square feet. The housing must be a light to medium gray color within the Federal Standard 595B ranges of 26250 to 26500 for semi-gloss sheen, or 36250 to 36500 for flat sheen.

Each housing must be provided with a slip fitter capable of mounting on a 2-inch pipe tenon. This slip fitter must fit on mast arms from 1-5/8 to 2-3/8 inch (O.D.). The slip fitter must be capable of being adjusted a minimum of ±5 degrees from the axis of the tenon in a minimum of five steps: +5, +2.5, 0, -2.5, -5. The clamping brackets of the slip fitter must not bottom out on the housing bosses when adjusted within the designed angular range. No part of the slip fitter mounting brackets on the luminaires must develop a permanent set in excess of 1/32 inch when the 2 or 4, 3/8 inch diameter cap screws used for mounting are tightened to 10 ft-lb. Two sets of cap screws may be supplied to allow for the slip fitter to be mounted on pipe tenon in the acceptable range without the cap screws bottoming out in the threaded holes.

The assembly and manufacturing process for the LED luminaire must be designed to assure internal components are adequately supported to withstand mechanical shock and vibration from high winds and other sources. Luminaires to be mounted on horizontal mast arms, when tested under California Test 611 must be capable of withstanding the following cyclic loadings in units of acceleration of gravity, G:

1. Vertical plane at a minimum peak acceleration level of 3.0G peak-to-peak sinusoidal loading (same as 1.5G peak) with the internal ballast removed, for a minimum of 2 million cycles without failure of luminaire parts.
2. Horizontal plane perpendicular to the direction of the mast arm at a minimum peak acceleration level of 1.5G peak-to-peak sinusoidal loading (same as 0.75G peak) with the internal ballast installed, for a minimum of 2 million cycles without failure of luminaire parts.
3. Vertical plane at a minimum peak acceleration level of 1.0G peak-to-peak sinusoidal loading (same as 0.5G peak) with the internal ballast installed, for a minimum of 2 million cycles without failure of luminaire parts.

The housing must be designed to prevent the build up of water on the top of the housing. Exposed heat sink fins must be oriented to allow the water to freely run off the luminaire and carry dust and other accumulated debris away from the unit. The optical assembly of the luminaire must be protected against dust and moisture intrusion per minimum requirements of IP-66. The electronics/power supply enclosure must be protected per minimum requirements of IP-43.

Each mounted luminaire may be furnished with or without a photoelectric unit receptacle. If a photoelectric unit receptacle is included, a rain tight shorting cap must be provided and installed. The receptacle must comply with Section 86-6.07B(1), "Photoelectric Unit," of the Standard Specifications. If the luminaire housing is provided with a hole for the receptacle, the hole must be closed, covered, and permanently sealed with weatherproof material.

When the components are mounted on a down-opening door, the door must be hinged and secured to the luminaire housing separately from the refractor or flat lens frame. The door must be secured to the housing in a manner to prevent its accidental opening. A safety cable shall mechanically connect the door to the housing.

Field wires connected to the luminaire must terminate on a barrier type terminal block secured to the housing. The terminal screws must be captive and equipped with wire grips for conductors up to No. 6. Each terminal position must be clearly identified.

The circuit board and power supply must be contained inside the luminaire. Circuit boards must conform to Chapter 1, Section 6 of the "Transportation Electrical Equipment Specifications".

Electrolytic capacitors used in the power supplies must be rated for -40 to 220 °F, long life (greater than 5000 hours), and operated at no more than 70 percent of its rated voltage and current.

Full compensation for light emitting diode luminaire is included in the contract lump sum price paid for modify lighting and sign illumination and no additional compensation will be allowed therefor.

### **10-3.18 SOFFIT AND WALL LUMINAIRES**

A No. 7 pull box shall be installed adjacent to each soffit luminaire as shown on the plans.

### **10-3.19 PHOTOELECTRIC CONTROLS**

Contactors shall be the mechanical armature type.

Photoelectric units for illuminated signs shall have a "turn-on" level of between 20 foot-candles and 30 foot-candles (corresponds to a switching level of approximately 40 foot-candles to 60 foot-candles measured in the horizontal plane). "Turn-off" level shall not exceed 3 times the "turn-on" level.

### **10-3.20 MODEL 500 CHANGEABLE MESSAGE SIGN SYSTEM**

Model 500 changeable message sign (CMS) systems consist of a Model 500 changeable message sign, a Model 170 controller assembly in a completely wired Type 1 or similar cabinet and the required wiring and auxiliary equipment required to control the CMS shown on the plans and in conformance with these special provisions.

The Model 500 changeable message signs, wiring harness and Model 170 controller assembly including controller unit and completely wired cabinet, but without anchor bolts, will be State-furnished in conformance with the provisions in "Materials" of these special provisions.

Model 500 changeable message sign system components will conform to the requirements in "Specifications for Changeable Message Sign System," issued by the State of California, Department of Transportation, and to the addenda thereto current at the time of project advertising. Model 170 controller assemblies will conform to the requirements in "Traffic Signal Control Equipment Specifications," issued by the State of California, Department of Transportation, and to the addenda thereto current at the time of project advertising.

Attention is directed to "Sign Structures" of these special provisions.

The sign assembly shall be installed on the sign structure. The controller cabinet foundation shall be constructed as shown on the plans for Model 334 cabinets (including furnishing and installing anchor bolts), the controller cabinet shall be installed on the foundation, and the field wiring connections shall be made to the terminal blocks in the sign assembly and in the controller cabinet.

Field conductors No. 12 and smaller shall terminate with spade terminals. Field conductors No. 10 and larger shall terminate in spade or ring terminals.

A listing of field conductor terminations, in each State-furnished changeable message sign and controller cabinet, will be furnished free of charge to the Contractor at the site of the work.

The location of the foundation for each controller cabinet will be determined by the Engineer.

State forces will maintain the sign assemblies. The Contractor's responsibility shall be limited to conformance with the provisions in Section 6-1.02, "State-Furnished Materials," of the Standard Specifications.

### 10-3.21 COMMUNICATION SYSTEM

Communication system at various locations must consist of, but not limited to:

1. Installing:
  - 1.1. Fiber optic traffic modems (FOTM), and connecting wires and cables,
  - 1.2. Conduits, innerducts, conductors and cables of various sizes, types, and installation methods,
  - 1.3. Splice vault, pull boxes of various sizes and types and installation methods,
  - 1.4. Fiber optic splice closures inside splice vault or pull boxes of various sizes and types,
  - 1.5 Other required incidental equipment.
- 2 Installing, and connecting conductors of various sizes, types and installation methods, including, but not limited to, conductors, and singlemode fiber optic cables (12SMFO and 48SMFO) cables, and incidentals to make the installed or connected equipment fully operational, complete in place, as shown on the plans, and as directed by the Engineer.

New equipment must be current standard production units and must have been in production for a minimum of 6 months.

The Contractor's attention is directed to "Video Link Testing" and "Data link testing" under "System Testing and Documentation", as described in these special provisions.

You must arrange, at your expense, to have a technician qualified to work on traffic signal and communication system routing materials and equipment present at the time these materials and equipment are installed, modified, connected, or reconnected.

### ABBREVIATIONS AND GLOSSARY

The following abbreviations and glossary apply to these special provisions.

#### ABBREVIATIONS

AVC	Automatic Vehicle Classification system
B8ZS	Bit eight Zero Suppression (data transmission protocol)
BERTS	Bit Error Rate Test Set
BITS	Building Integrated Timing Supply
BNC	Bayonet Navy Connector
bps	Bits per second
CMS	Changeable Message Sign
CTS	Clear to Send
D4	4 <sup>th</sup> version of the D-signal format for time division multiplexers
dB	Decibel
dBm	Decibel referred to milliwatts
dBm	Decibel above reference noise
DCD	Data Carrier Detect
DEMUX	Demultiplexer
DS-1	Digital Signal Level 1. Digital transmission rate of 1.544 megabits per second.
DTE	Data Terminal Equipment
ESF	Extended Superframe Format
FXS	Foreign eXchange Subscriber
ITU	International Telecommunications Union
LA	Los Angeles
MUX	Multiplexer
NHD	North Hollywood
OTDR	Optical Time Domain Reflectometer
p-p	Peak to peak
PC	Personal computer
RUS	United States Rural Utilities Service
RMS	Ramp Metering System
RTS	Request To Send
Rx	Receive
SM	Singlemode
SMFO	Singlemode Fiber Optic

ST	Type of connector
TIA	Telecommunications Industry Association
TLP	Transmission Level Point
TMC	Traffic Management Center
Tx	Transmit
UV	Ultraviolet
WTO	Wire Transit Only

## GLOSSARY

**Breakout:** Cable "breakout" is produced by removing jackets just beyond the last tie-wrap point, exposing 3 to 6 feet of cable buffers, Aramid strength yarn and central fiberglass strength members and cutting Aramid yarn, central strength members and buffer tubes to expose individual glass fibers for splicing or connection to the appropriate device.

**Cable Storage Cabinet:** A cabinet for holding excess cable slack, allowing flexibility in equipment location and allowing cable pulling for re-splicing.

**Channel:** An information path between a discrete input and a discrete output. One single input to a multiplexer or output from a demultiplexer.

**Closed Circuit Television Assembly:** Camera, lens, environmental enclosure, and necessary connectors and cables.

**Connector:** A mechanical device providing the means for attaching to and decoupling from a transmitter, receiver or another fiber (such as on a patch panel).

**Connectorized:** A fiber with a connector affixed to it.

**Connector Module Housing (CMH):** A patch panel used in the FDF to terminate singlemode fibers with most common connector types. It may include a jumper storage shelf and a hinged door.

**Couplers:** Devices normally located within FDF's mounted in panels, that mate 2 fiber optic connectors to facilitate the transition of optical light signals from one connector into another. They may also be used unmounted, to join 3 simplex fiber runs. Couplers may also be referred to as adapters, feed-throughs and barrels.

**Fiber Distribution Frame (FDF):** A rack mounted system usually installed in the TMC that consists of a standard equipment rack, fiber routing guides, horizontal jumper troughs, fiber distribution units (FDU), connector module housings (CMH) and splice module housings (SMH).

FDF's serves as the "home" for passive fiber optic components from cable breakout, for connection by jumpers, to the electronics.

**Fiber Distribution Unit (FDU):** An enclosure containing a Connector Module Housing (CMH) and a Splice Module Housing enclosure.

**Field Cabinet:** A roadside cabinet housing controllers or communications equipment.

**Intermediate Distribution Frame Room (IDF room):** The room or area inside a hub or hut containing the FDF and other distribution hardware.

**Jumper:** A short fiber optic cable with connectors installed on both ends, typically used for connection within an FDF.

**Light Source:** A portable piece of fiber optic test equipment used to perform end-to-end attenuation testing in conjunction with a power meter containing a stabilized light source operating at the designed wavelength of the system under test.

**Link:** A passive section of the system, the ends of which are to be connected to active components. A link may include splices and couplers. For example, a video link may be from a F/O transmitter to a video Multiplexer (MUX).

**Main Distribution Frame Room (MDF room):** The room inside the TMC which contains the FDF and other distribution hardware.

**Mux/Demux:** Multiplexer/Demultiplexer.

**Optical Time Domain Reflectometer (OTDR):** Fiber optic test equipment used to measure total amount of power loss between 2 points and the corresponding distance. It provides a visual and printed display of the relative location of system components such as fiber sections, splices and connectors and as losses attributable to each component or defect in fiber.

**Patchcord:** A short jumper.

**Pigtail:** A short length of fiber optic cable with a connector installed on one end.

**Power Meter:** A portable fiber optic test equipment used to perform end-to-end attenuation testing in conjunction with a light source, containing a detector that is sensitive to light at the designed wavelength of the system under test. Its display indicates the amount of power injected by the light source that arrives at the receiving end of the link.

**Segment:** A section of F/O cable not connected to an active device which may or may not have splices per the design.

**Splice Closure:** An environmentally sealed container used to organize and protect splice trays, normally installed in a splice vault that allows splitting or routing of fiber cables from multiple locations.

**Splice Module Housing (SMH):** A housing for storage of splice trays, pigtails and short cable lengths.

**Splice Tray:** A container used to organize and protect spliced fibers.

**Splice Vault:** An underground vault used to house splice closures.

## **COMMUNICATION CONDUIT**

Communication conduit must conform to the details on the plans and comply with Section 86-2.05, "Conduit," of the Standard Specifications and these special provisions.

Conduit must enter splice vaults and communication pull boxes through knockouts. Conduits entering ends of communication pull boxes must be vertically and horizontally aligned with conduits at the opposite end of communication pull boxes. Conduit ends must not extend beyond interior wall of splice vaults and communication pull boxes. Space around conduits through end walls of splice vaults and communication pull boxes must be filled with minor concrete cement mortar conforming to the provisions in Section 51-1.135, "Mortar," of the Standard Specifications. Conduit bodies or communication pull boxes must not be used in lieu of specified bends to change the direction of communication conduit runs, except where specified.

Bends must not be placed in sections of conduit in excess of those indicated on the plans without the approval of the Engineer. The total degrees of bending in a section of conduit between splice vaults and communication pull boxes must not exceed a total of 180 degrees, except where specified.

Changes in indicated conduit bends may be made to suit field conditions if the change reduces the degree of bend or increases the radius of bend. The angle of the bend must not be decreased without the approval of the Engineer.

Minimum bending radius for 2 inches, 3 inches and 4 inches communication conduits must be 24 inches, 36 inches and 48 inches, respectively. Bends greater than 22 degrees must be factory bends and bends greater than 45 degrees must be galvanized rigid steel with necessary adapters.

Deflections of communication conduit must not exceed one inch/foot when avoiding obstructions. Conduit from typical trench sections must not deflect by more than one inch/foot from the alignment preceding or following communication pull boxes and splice vaults.

Where edge drains are in the path of conduit routing, you must first locate edge drains, then install conduit maintaining a minimum depth of 24 inches. If an edge drain is damaged by your work, repairs must be at your expense.

Conduit adjacent to overcrossings or bridge foundations must be trenched and installed in shoulders as close as possible to the edge of traveled way.

New communication conduits must not terminate in power pull boxes.

## **COMMUNICATION CONDUIT (BRIDGE)**

Type 1 conduit must be used for communication conduit (bridge) and must conform to the details shown on the plans and to these special provisions.

Excavation and slurry cement must conform to Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications. Slurry cement backfill must reach initial set prior to placing reinforced concrete for approach slabs.

Where conduits are installed in soil, a 52 inches minimum bending radius for conduit installation from soil to pavement transition must be provided.

### **Metal Supports (Bridge)**

Wrapping tape for pipes in contact with soils must be a pressure sensitive polyvinyl chloride or polyethylene tape with a minimum thickness of 50 mil.

Anchor bolts, clevis plate, pipe clamps, nuts and bolts, and other fittings must be suitable for the type and size of the supply lines or casing and must conform to the provisions in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

Metal supports (bridge) must consist of galvanized steel pipe hangers/clamps, anchor bolts/rods, clevis plate, steel brackets and other fittings, and, where shown on the Standard plans, a stainless steel pipe protection shield.

Epoxy adhesive must conform to the provisions in Section 95-1, "General," of the Standard Specifications.

## **COLORED CEMENT BACKFILL**

Slurry cement backfill for installation of communication conduits that will contain fiber optic cables must be a medium to dark, red or orange color. Concrete must be pigmented by addition of commercial quality cement pigments to concrete mixes. Red or orange concrete pigment must be LM Scofield Company; Orange Chromix Colorant; Davis Colors; or equal. The concrete must conform with the provisions in Section 90-10, "Minor Concrete," of the Standard Specifications.

Excavation and slurry cement backfill shall conform to Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications. Slurry cement backfill shall reach initial set prior to placing reinforced concrete for approach slabs.

For trenches in pavement areas, the top 4-inch of slurry cement backfill must be pigmented concrete.

The size of the aggregate must not be larger than 0.375 inch.

## **TRACER WIRE**

Tracer wire must be provided and placed in communication conduits containing fiber optic cable as shown on the plans.

Tracer wire must be No. 12 minimum solid copper conductor with Type TW, THW, RHW, or USE insulation. A minimum of 3 ft of slack must be extended into each communication pull box and splice vault from each direction.

The tracer wire must form a mechanically and electrically continuous line throughout the length of the trench. Where trenched communication conduit joins metal conduit that has been jacked or drilled, the tracer wire must be bonded to the metal conduit with a brass grounding clamp.

Tracer wire may be spliced at intervals of not less than 500 feet and in pull boxes. Splices must conform to Section 86-2.09, "Wiring," of the Standard Specifications.

## **PLASTIC SHEET (20 mil)**

Plastic sheets, 20 mil thick, manufactured from high density polyethylene (HDPE) virgin compounds or polyvinyl chloride (PVC) virgin compounds, must be furnished and installed in trenches within roadway pavement, 0.10-foot over new communication conduits, as shown on the plans and as directed by the Engineer.

## **ONE INCH INNERDUCT**

Innerducts must be installed to protect fiber optic cables. Separate innerducts must be installed for each fiber optic cable along communication mainlines, unless otherwise shown on the plans,

Innerducts must be one inch, smooth or ribbed high density polyethylene (HDPE) duct with the following characteristics:

1. Inner diameter greater than or equal to one inch, nominal.
2. Environmental stress crack resistance in excess of 2000 hours at -148 °F, no failures.
3. Cold impact resistance to -105 °F not brittle until -148 °F.
4. Minimum tensile strength of 600 pounds for finished product.
5. Minimum crush strength of 650 pounds.
6. Coefficient of friction less than 0.4 unlubricated on nonmetallic conduit and with common polyethylene cable jackets.

Yellow must be used for the 48SMFO fiber optic cables used for video/data and contrasting colors approved by the Engineer for the 48SMFO for video distribution. Exteriors of innerducts must be marked with sequential measurement markings each meter.

Innerduct must be installed using manufacturer's recommended practices using cable pulling lubricants recommended by the innerduct manufacturer and pull ropes conforming to the requirements in Section 86-2.05C, "Installation," of the Standard Specifications. If innerduct is installed with adjacent cables in the same conduit, innerducts and cables must be installed together in one operation. Innerducts must be installed in continuous runs between communication pull boxes and splice vaults without splices or joints.

Ends must be smooth to prevent scraping of cables. Dynamometers must be used to record installation tensions and tension limiting devices must be used to prevent exceeding maximum pulling tensions during installation. Breakaway devices must be used to limit pulling tensions. One device must be placed in series with every element rated for less than maximum pulling tensions of that element. Innerducts must not be stressed beyond the minimum-bending radius allowed by the innerduct or fiber optic cable manufacturer.

Tension must be set to the manufacturer's maximum limit. Maximum pulling tension must be recorded for each innerduct run.

Immediately prior to installing cables, innerducts must be blown out with compressed air until foreign material is removed. After cables have been installed, ends of innerducts must be sealed with an approved type of sealing compound.

## **WARNING TAPE**

Warning tape must be furnished, installed and placed in the trench over new conduits to receive reinstalled or new communication fiber optic conduit, as shown on the plans.

The warning tape must be:

Description	Parameter
Warning tape thickness	not be less than 4 mil thick
Warning tape width	6 inches
Warning tape material	pigmented polyolefin film
Warning tape tensile strength	minimum of 2800 psi for 6 inches wide strip
Warning tape elongation	minimum of 500 percent elongation before breakage
Printed Text height	1 inch
Message background color	bright orange color background
Message statement	CAUTION: BURIED FIBER OPTIC CABLE – CALTRANS (323)259-1922,
Message spacing intervals	approximately 30 inches

The printed warning must not be removed by the normal handling and burial of the tape and must be rated to last the service life of the tape.

The construction of the warning tape must be such that it will not delaminate when it is wet. It must be resistant to insects, acid, alkaline and other corrosive elements in the soil.

### **FIBER UNDERGROUND WARNING SIGN**

Communication conduits installed in soil more than 30 feet from edge of travelled way (ETW) must have warning signs placed within 15 feet of conduit at minimum 200-foot intervals.

Signs must contain the message, "FIBER UNDERGROUND CALL (323) 259-1922 CALTRANS TMC OPERATOR." Dimensions of signs must be a minimum of 5" x 6.7" x 0.08" made of galvanized sheet metal or aluminum sheet. Sign colors must be white lettering with black background. Signs must be bolted to right of way fence at a height of 5 feet. If the right of way fence is not within 16 feet of conduit, signs must be installed on metal posts in conformance with Standard Plan A73B.

### **COMMUNICATION PULL BOXES**

Communication pull boxes must comply with Section 86-2.07, "Traffic Pull Boxes," of the Standard Specifications and these special provisions.

Communication pull box steel covers must have "CALTRANS COMMUNICATION" markings.

Pull boxes must have tamper proof bolts to secure the cover/metal lid to the box. Tamper proof bolts must be approved by the Engineer before ordering and installing.

Concrete placed around and under communication pull boxes must contain a minimum of 20 pounds of cement per cubic foot.

Steel covers must be installed and kept bolted down.

Communication pull boxes shown on the plans in shoulders are shown for general location. The exact location must be outside of paved shoulders and will be determined by the Engineer.

Additional communication pull boxes must not be installed without the Engineer's written approval.

### **SPLICE VAULT**

Splice vaults must be 60" (L) x 30" (W) x 30" (D) nominal inside dimensions and must conform to Section 86-2.06, "Pull Boxes," of the Standard Specifications and these special provisions. Covers must be in one or 2 sections with inset lifting pull shots in each portion. Cover markings must be labeled "CALTRANS COMMUNICATION" on each cover section. Enclosures, covers and extensions must be concrete gray. Vault and covers may be constructed of reinforced portland cement concrete or of non-PCC material.

Splice vaults must have tamper proof bolts to secure the cover/metal lid to the box. Tamper proof bolts must be approved by the Engineer before ordering and installing.

Non-PCC vault and covers must be sufficiently rigid that when a 100 pounds concentrated force is applied perpendicular to the midpoint of one of the long sides at the top, while the opposite long side is supported by a rigid surface, the cover may be removed without the use of tools. When a vertical force of 1500 pounds is applied, through a 0.5" x 3" x 6" steel plate, to a non-PCC cover in place on a splice vault, the cover must not fail and must not deflect more than 0.25 inch.

Splice vaults must be installed as detailed and where shown on the plans. Splice vaults and covers must have an AASHTO HS 20-44 rating where shown on the plans, except in areas protected from vehicular traffic, may be rated for AASHTO H5 loads (25 percent of HS 20-44).

Splice vaults must be installed one inch above grade in unpaved areas.

Splice vaults shown on the plans in shoulders are shown for general location. Exact locations will be determined by the Engineer.

Metallic or non-metallic cable racks must be installed on the interior of both sides of splice vaults. Racks must be capable of supporting a load of 100 pounds, minimum, per rack arm. Racks must be supplied in lengths appropriate to boxes in which they will be placed. Rack arms must not be less than 6 inches in length. Metallic cable racks must be fabricated from ASTM Designation: A36 steel plate and must be hot-dip galvanized after fabrication. Steel plate, hardware, and galvanizing must conform to the requirements in Section 75, "Miscellaneous Metal," of the Standard Specifications. Metallic cable racks must be bonded and grounded.

## **FIBER OPTIC CABLE**

Fiber optic cable must conform to the details shown on the plans and these special provisions.

### **Definitions**

The following definitions must apply to fiber optics:

1. Active Component Link Loss Budget: Difference between average transmitter launch power (in dBm) and receiver maximum sensitivity (in dBm).
2. Backbone: Fiber cable that provides connections between the Los Angeles Transportation Management Center (LARTMC) and hubs, as well as between equipment rooms or buildings, and between hubs. The term is used interchangeably with "trunk" cable.
3. Distribution Cable: Fiber cable that provides connections between hubs. Drop cables are typically spliced into distribution cables.
4. Drop Cable: Fiber cable that provides connections between distribution cables to field elements. Typically these run from splice vaults to splice trays within field cabinets. Drop cables are usually short in length (less than 65 feet) and are of the same construction as outside plant cable. "Breakout cable" is used interchangeably with drop cable.
5. End-to-End Loss: The maximum permissible end-to-end system attenuation is the total loss in a given link. This loss could be actual measured loss or calculated using typical (or specified) values. This number will determine the amount of optical power (in dB) needed to meet the System Performance Margin.
6. Fan Out Termination: Permits branching of fibers contained in optical cables into individual cables and can be done at field locations, allowing cables to be connectorized or terminated per system requirements. A kit provides pullout protection for individual bare fibers to support termination. It provides 3 layers of protection consisting of a Teflon inner tube, a dielectric strength member, and an outer protective PVC jacket. Fan out terminations must not be used for more than 6 fibers. Use of a patch panel would be appropriate.
7. F/O: Fiber optic.
8. FOOP: Fiber optic outside plant cable.
9. FOTP: Fiber optic test procedures as defined by TIA/EIA standards.
10. Loose Tube Cable: Type of cable construction in which fibers are placed in buffer tubes to isolate them from outside forces (stress). A flooding compound or material is applied to the interstitial cable core to prevent water migration and penetration. This type of cable is primarily for outdoor applications.
11. Mid-span Access Method: Procedure in which fibers from a single buffer tube are accessed and spliced to an adjoining cable without cutting unused fibers in buffer tubes, or disturbing remaining buffer tubes in cables.
12. Patch Panel: Precision drilled metal or punched frame containing couplers used to mate 2 fiber optic connectors.
13. SMFO: Singlemode Fiber Optic Cable.
14. Splice: Permanent joining of 2 fiber ends using a fusion splicer.
15. System Performance Margin: Calculation of the overall "End to End" permissible attenuation from the fiber optic transmitter (source) to the fiber optic receiver (detector). The system performance margin should be at least 6 dB. This includes the difference between the active component link loss budget, the passive cable attenuation (total fiber loss), and the total connector/splice loss.
16. Tight Buffered, Non-Breakout Cable (Tight Buffer Cable): Type of cable construction where glass fiber is tightly buffered (directly coated) with a protective thermoplastic coating to 35 mil (compared to 10 mil for loose tube fibers).

### **Fiber optic outside plant cable**

Fiber optic outside plant cable (FOOP) must be, nongel filled or water-blocking material, duct type, with loose buffer tubes. Cables with singlemode fibers must contain 12 and 48 singlemode (SM) dual-window (1310 nm and 1550 nm) fibers. Optical fibers must be contained within loose buffer tubes stranded around a dielectric central member. Aramid yarn or fiberglass must be used as a primary strength member, and a polyethylene outside jacket must provide protection.

Fiber optic (F/O) cable must be from the same manufacturer who is regularly engaged in the production of fiber optic cables.

Cables must be compliant with 7 CFR 1755.900 (RUS Bulletin 1753F-601), "RUS Specification for Filled Fiber Optic Cables."

CABLE TYPE	DESCRIPTION
E	12SMFO
H	48SMFO

**Fiber Characteristics**

Optical fiber must be glass and consist of a doped silica core surrounded by concentric silica cladding. Fibers in buffer tubes must be usable fibers, and must be free of surface imperfections and occlusions. Required fiber grade must reflect the maximum individual fiber attenuation.

Coating must be dual layered, UV cured acrylate, mechanically or chemically strippable without damaging fibers.

Cable must comply with optical and mechanical requirements over an operating temperature range from -40 to +165 °F and must be tested in accordance with EIA-455-3A (FOTP-3), "Procedure to Measure Temperature Cycling Effects on Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components." Change in attenuation at extreme operational temperatures (from -40 to +165 °F) for singlemode fiber must not be greater than 0.32 dB/mi, with 80 percent of measured values no greater than 0.16 dB/mi. Singlemode fiber measurement must be made at 1550 nm.

The attenuation for fibers must be a maximum attenuation for each fiber over the entire operating temperature range of the cable.

Fibers within finished cables must meet the following requirements:

Fiber Characteristics Table	
Parameters	Multimode
Type	Graded index
Core diameter	2 ± 0.08 mil
Cladding diameter	5 ± 0.08 mil
Core to Cladding Offset	< 0.12 mil
Coating Diameter	10 ± 0.39 mil
Cladding Non-circularity defined as: [1-(min. cladding dia ÷max. cladding dia.)] x 100	< 2.0%
Proof/Tensile Test	50 ksi, Min.
Attenuation: (-40 °to +165 °F)	
@850 nm	< 4 dB/mi
@1300 nm	< 1.6 dB/mi
Attenuation at the Water Peak	N/A
Bandwidth:	
@ 850 nm	> 186 MHz x mi
@1,300 nm	> 621 MHz x mi
Numerical Aperture (measured in Accordance with EIA-455-47)	0.20 ± 0.02

Fiber Characteristics Table	
Parameters	Singlemode
Type	Step Index
Core diameter	0.33 mil (nominal)
Cladding diameter	5 ±0.04 mil
Core to Cladding Offset	≤0.03 mil
Coating Diameter	10 ±0.31 mil
Cladding Non-circularity defined as: [1-(min. cladding dia ÷max. cladding dia.)] x 100	≤ 1.0%
Proof/Tensile Test	50 ksi, Min.
Attenuation: (65 to +165 °F) @1310 nm @1550 nm	≤0.6 dB/mi ≤0.5 dB/mi
Attenuation at the Water Peak	≤3.4 dB/mi @ 1383 ±3 nm
Chromatic Dispersion: Zero Dispersion Wavelength Zero Dispersion Slope	1301.5 to 1321.5 nm ≤0.15 ps/(nm <sup>2</sup> *mi)
Maximum Dispersion:	≤5.3 ps/(nm*mi) from 1285 to 1330 nm <29 ps/(nm*mi) for 1550 nm
Cut-Off Wavelength	<1260 nm
Numerical Aperture (measured in Accordance with EIA-455-47)	N/A
Mode Field Diameter (Petermann II)	0.37 ±0.02 mil at 1310 nm 0.41 ±0.04 μm at 1550 nm

### Color Coding

In buffer tubes containing multiple fibers, length of fiber must be distinguishable from others in the same tube by means of color-coding according to the following:

1. Blue (BL)	7. Red (RD)
2. Orange (OR)	8. Black (BK)
3. Green (GR)	9. Yellow (YL)
4. Brown (BR)	10. Violet (VL)
5. Slate (SL)	11. Rose (RS)
6. White (WT)	12. Aqua (AQ)

Buffer tubes containing fibers must be color-coded with distinct and recognizable colors according to the table listed above for fibers.

Colors must be in accordance with the Munsell color shades (ASTM D 1535-1) and must meet EIA/TIA-598 "Color Coding of Fiber Optic Cables."

Color formulations must be compatible with fiber coatings and buffer tube filling compounds, and be heat stable. Colors must not fade or smear or be susceptible to migration and must not affect transmission characteristics of optical fibers and must not cause fibers to stick together.

### Cable Construction

Fiber optic cable must consist of, but not limited to, the following components:

- A. Buffer tubes
- B. Central member
- C. Filler rods
- D. Stranding
- E. Core and cable flooding
- F. Tensile strength member
- G. Ripcord
- H. Outer jacket

### **Buffer Tubes**

Clearance must be provided in loose buffer tubes between fibers and insides of tubes to allow for expansion without constraining fibers. Fibers must be loose or suspended within tubes and must not adhere to insides of buffer tubes. Buffer tubes must contain a maximum of 12 fibers.

Loose buffer tubes must be extruded from material having a coefficient of friction sufficiently low to allow free movement of fibers. Material must be tough and abrasion resistant to provide protection of fibers and permit safe intentional "scoring" and breakout without damaging or degrading internal fibers.

Buffer tube filling compound must be a homogeneous hydrocarbon-based gel with anti-oxidant additives used to prevent water intrusion and migration. Filling compound must be non-toxic and dermatologically safe to exposed skin, chemically and mechanically compatible with cable components, non-nutritive to fungus, non-hygroscopic and electrically non-conductive. Filling compound must be free from dirt and foreign matter and must be readily removable with conventional nontoxic solvents.

Buffer tubes must be stranded around a central member by a method, such as the reverse oscillation stranding process, which will prevent stress on fibers when the cable jacket is placed under strain.

### **Central Member**

The central member must be a glass reinforced plastic rod with similar expansion and contraction characteristics as the optical fibers and buffer tubes. A symmetrical linear overcoat of polyethylene may be applied to central members to achieve optimum diameter to ensure proper spacing between buffer tubes during stranding.

### **Filler Rods**

Fillers must be included in cables to maintain symmetry of cable cross-sections. Filler rods must be solid medium or high-density polyethylene. The diameter of filler rods must be the same as the outer diameter of buffer tubes.

### **Stranding**

Completed buffer tubes must be stranded around the central member using stranding methods, lay lengths and positioning so cables meet mechanical, environmental and performance specifications. A polyester binding must be applied over stranded buffer tubes to hold them in place. Binders must be applied with sufficient tension to secure buffer tubes to central members without crushing buffer tubes. Binders must be non-hygroscopic, non-wicking (or rendered so by the flooding compound) and dielectric with low shrinkage.

### **Core and Cable Flooding**

Cable core interstices must contain a water blocking material to prevent water ingress and migration. Water blocking material must be a polyolefin based compound, which fills the cable core interstices, or an absorbent polymer, which fills voids and swells to block ingress of water. Flooding compound or material must be homogeneous, non-hygroscopic, electrically non-conductive, non-nutritive to fungus, nontoxic, dermatologically safe, and compatible with other cable components.

### **Tensile Strength Member**

Tensile strength must be provided by high tensile strength aramid yarns or fiberglass helically stranded evenly around cable cores and must not adhere to other cable components.

### **Ripcord**

Cables must contain at least one ripcord under the jacket for easy sheath removal.

### **Outer Jacket**

Jackets must be free of holes, splits, and blisters and must be medium or high-density polyethylene (PE), or medium density cross-linked polyethylene with minimum nominal jacket thickness of  $39 \pm 3$  mil. Jacketing material must be applied directly over tensile strength members and water blocking materials and must not adhere to Aramid strength materials. Polyethylene must be carbon black and must not promote fungus growth.

Jackets or sheaths must be marked with the manufacturer's name, the words "Optical Cable", the number of fibers, "SM", year of manufacture, and sequential measurement markings every meter. Actual cable lengths must be within -0/+1 percent of length markings. Markings must be a contrasting color to cable jackets. Heights of markings must be  $98 \pm 8$  mil.

## **General Cable Performance Specifications**

Contractor must provide documentation showing compliance with the following performance specifications:

1. F/O cable must withstand water penetration when tested with 3 feet static head or equivalent continuous pressure applied at one end of a 3 feet length of filled cable for one hour. No water must leak through open cable ends. Testing must be in accordance with EIA-455-82 (FOTP-82), "Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable."
2. A representative sample of cable must be tested in accordance with EIA/TIA-455-81 (FOTP-81), "Compound Flow (Drip) Test for Filled Fiber Optic Cable". No preconditioning period must be conducted. Cables must exhibit no flow (drip or leak) at 158 °F as defined in the test method.
3. Crush resistance of finished F/O cables must be 125 pounds per inch applied uniformly over the length of cables without showing evidence of cracking or splitting when tested in accordance with EIA-455-41 (FOTP-41), "Compressive Loading Resistance of Fiber Optic Cables". The average increase in attenuation for fibers must be 0.10 dB at 1550 nm (singlemode) for a cable subjected to this load. Cables must not exhibit measurable increase in attenuation after removal of load. Testing must be in accordance with EIA-455-41 (FOTP-41), except that loads must be applied at the rate of 0.1 to 0.8 inch per minute and maintained for 10 minutes.
4. Cables must withstand 25 cycles of mechanical flexing at a rate of 30 ±1 cycles/minute. The average increase in attenuation for fibers must be less than or equal to 0.20 dB at 1550 nm (singlemode) at the completion of testing. Outer cable jacket cracking or splitting observed under 10x magnification constitute failure. Testing must be conducted in accordance with EIA-455-104 (FOTP-104), "Fiber Optic Cable Cyclic Flexing Test," with sheave diameters a maximum of 20 times the outside diameter of cables. Cables must be tested in accordance with Test Conditions I and II of FOTP-104.
5. Cables must withstand 20 impact cycles, with a total impact energy of 4.4 pounds•ft. Impact testing must be conducted in accordance with TIA/EIA-455-25B (FOTP-25) "Impact Testing of Fiber Optic Cables and Cable Assemblies." The average increase in attenuation for fibers must be <0.20 dB at 1550 nm for singlemode fiber. Cables must not exhibit evidence of cracking or splitting.
6. Finished cable must withstand a tensile load of 600 pounds without exhibiting an average increase in attenuation of greater than 0.20 dB (singlemode). Testing must be conducted in accordance with EIA-455-33 (FOTP-33), "Fiber Optic Cable Tensile Loading and Bending Test." Load must be applied for 30 minutes in Test Condition II of the EIA-455-33 (FOTP-33) procedure.

## **Packaging and Shipping Requirements**

Documentation of compliance to specifications must be provided to the Engineer prior to ordering materials.

Attention is directed to "Fiber Optic Testing," of these special provisions.

Completed cables must be packaged for shipment on reels. Cables must be wrapped in weather and temperature resistant covering. Ends of cables must be sealed to prevent ingress of moisture.

Ends of cables must be securely fastened to reels to prevent cables from coming loose during transit. Thirteen feet of cable on ends of cables must be accessible for testing.

Cable reels must have durable, weatherproof labels or tags showing the manufacturer's name, cable type, the actual length of cable on reels, your name, the contract number, and the reel number. A shipping record must be included in a weatherproof envelope showing the above information, including the date of manufacture, cable characteristics (size, attenuation, bandwidth, etc.), factory test results, cable identification number and other pertinent information.

Minimum hub diameter of reels must be at least 30 times the diameter of the cable. F/O cable must be in one continuous length per reel with no factory splices in fibers. Reels must be marked to indicate the direction reels should be rolled to prevent loosening of cables.

Installation procedures and technical support information must be furnished at the time of delivery.

## **LABELING**

### **General**

Label fiber optic cables permanently. Tags must be material designed for long term permanent labeling of fiber optic cables. Metal tags must be stainless steel with embossed lettering. Non-metal label materials must be approved by the Engineer and marked with permanent ink. Labels must be affixed to cables per the manufacturer's recommendations and must not be affixed in a manner, which will cause damage to fibers. Handwritten labels will not be allowed.

### **Label Identification**

#### **Labeling of Cables**

Labeling of backbones, distribution and drop fiber optic cables must conform to the following unique identification code elements:

UNIQUE IDENTIFICATION CODE ELEMENTS For Backbone, Distribution or Drop Cables		
DESCRIPTION	CODE	NUMBER OF CHARACTERS
District	District number	2
Cable Type	Fiber: S: Singlemode	1
Cable fiber (or copper pairs) Count	Number of fibers or conductor pairs (Examples: 144 fibers; or 100 TWP)	3
Route Number	Hwy. Rte (Example: 005)	3
Begin Function	T: TMC; H: HUB; V: Video Node; D: Data Node; C: Cable Node; M: CCTV Camera; N: CMS; P: Traffic Signal; Z: Ramp Meter; U: Traffic Monitoring/Count Station/Vehicle Count Station (VDS, TOS); S: Splice Vault	1
Begin Function Number	Unique ID number corresponds to Begin Function (Example: H02 [Hub 02])	2
End Function	T: TMC; H: HUB; V: Video Node; D: Data Node; C: Cable Node; M: CCTV Camera; N: CMS; P: Traffic Signal; Z: Ramp Meter; U: Traffic Monitoring/Count Station; S: Splice Vault	1
End Function Number	Unique ID number corresponds to Begin Function (Example: H03 [Hub 03])	2
Unique Identifier	XX: If 2 or more cables of the same count are in the same run	2
<b>TOTAL</b>		<b>17</b>

Cables must display one unique identification, regardless of where the cable is viewed. The begin function and end function correspond to end points of cables. The order of the begin and end functions follow the hierarchy listed below, where the lowest number corresponding to the begin/end function is listed first.

List of Hierarchy										
1	2	3	4	5	6	7	8	9	10	11
TMC	HU B	Video Node (VN)	Data Node (DN)	Cable Node	CCTV Camera	CMS	Traffic Signal	Ramp Meter	Traffic Monitoring/ Count Station	Splice Vault

A cable between the TMC and a HUB will have the TMC listed as the start function and the HUB as the end function. Between a CMS and a Splice Vault, the start function will be listed as the CMS, and so on. If a cable is connected between HUBs, the lowest number, will be listed as the start function.

A cable labeled 07S060010H02H0302 would contain the following information:

District	Mode	# of fibers	Route	Begin	End	Unique ID
07	S	060	010	H02	H03	02

Example: 07S060010H02H0302

This cable is located in District 7, identified as a singlemode fiber optic cable containing 60 fibers, installed along Route 10, beginning in Hub 2, and ending in Hub 3, with unique ID of number 2. The implication for the unique ID is that there may be another 60 fiber optic cable between those hubs. This is an example for a backbone cable.

### Labeling Jumpers and Pigtails

Labeling jumpers and pigtails must conform to the following unique identification code elements:

UNIQUE IDENTIFICATION CODE ELEMENTS for JUMPERS (active component to FDU) and PIGTAILS (to connector # on patch panel)		
DESCRIPTION	CODE	NUMBER OF CHARACTERS
Hub Identifier	Hub, TMC , VN or DN ID Numbers or Alphanumeric or both	2
From (Source) Device	MU: Multiplexer FD: FDU (Fiber Distribution Unit) RP: Repeater	2
From (Source) Device Identifier	Numbers or Alphanumeric or both	2
Transmitter or Receiver	T or R	1
To (Destination) Device	MU: Multiplexer FD: FDU (Fiber Distribution Unit) RP: Repeater	2
To (Destination) Device Identifier	Numbers or Alphanumeric or both	2
Connector Identifier	Connector ID	2
TOTAL		13

A pigtail labeled 01MU01TFD0203 would contain the following information:

Hub	Multiplexer	Transmitting to	To Patch Panel Position (Connector)
01	MU01	TFD02	03

Example: 01MU01TFD0203.

This pigtail is located in Hub 1, from multiplexer 01, transmitting to FDU 02 to patch panel position (connector) 03.

### Label Placement

Label placement must be as following:

1. Cables: Cables must be labeled with the unique identification code element method at terminations, even if no connections or splices are made, and at splice vault entrances and exits.
2. Cable to Cable Splices: Cable jackets entering splice closures must be labeled in accordance with the identification method.
3. Cable to Fiber Distribution Units: Cable jackets must be labeled at entries to FDU's in accordance with the unique identification code element method. Fibers must be labeled with Fiber IDs and pigtails must be labeled at connectors with Fiber IDs. FDU's must be labeled with Cable IDs on faces of FDU's. If multiple cables are connected to FDU's, each block of connectors relating to individual cables must be identified by a single label with Cable IDs. Individual connections must be marked on the face of FDU's in the designated area with Fiber IDs.
4. Fiber: Fiber labels must be placed next to connectors of individual fibers.
5. Patch Panels: Cable jackets must be labeled at entries to Patch Panels in accordance with the unique identification code element method. Fibers must be labeled with Fiber IDs and pigtails must be labeled at connectors with Fiber IDs. Patch panels must be labeled with Cable IDs on faces of Panels. If multiple cables are connected to Patch Panels, each block of connectors relating to individual cables must be identified by a single label with the Cable ID. Individual connections must be marked on faces of Panels in the designated area with Fiber IDs.
5. Jumpers: Equipment to FDU jumpers must be labeled as to equipment type connected and must be labeled at both ends. FDU to FDU jumpers must be labeled at each end in accordance with the unique identification code element method.
6. Pigtails: Pigtails must be labeled at the connector in accordance with the unique identification code element method described elsewhere in these special provisions.
7. Copper Cable Labels: Twisted-pair communications cables must be labeled in accordance with the unique identification code element method.

## **CABLE INSTALLATION**

Cable installation must be in conformance with the procedures specified by the cable manufacturer. Submit the manufacturer's recommended procedures for pulling fiber optic cable at least 20 working days prior to installing cable. Mechanical aids may be used if a tension measuring device and break-away swivel are placed in tension to the end of cables. Tension in cables must not exceed 500 pounds or the manufacturer's recommended pulling tension, whichever is less.

Bend radius must be a minimum of 20 times the outside diameter during installation. Cable grips for installing fiber optic cables must have a ball bearing swivel to prevent cables from twisting during installation.

F/O cable must be installed using a cable pulling lubricant recommended by the F/O cable manufacturer and a pull rope conforming to Section 86-2.05, "Conduit," of Standard Specifications. Personnel must be stationed at splice vaults and pull boxes through which cables are pulled to lubricate and prevent kinking or other damage.

F/O cable must be installed without splices except where allowed on the plans and must be limited to one cable splice every 4 miles if splice locations are not shown on the plans. Midspan access splices or FDU terminations must involve fibers being spliced as shown on the plans. Cable splices must be located in splice closures installed in splice vaults. A minimum of 65 feet of slack must be provided for F/O cables at splice vaults. Slack must be divided equally on each side of F/O splice closures.

F/O cable must be installed in individual innerduct unless shown on the plans. Pulling separate F/O cables into spare ducts to replace damaged fiber will not be allowed.

Fiber may be installed using the air blown method. If integral innerduct is used, duct splice points or temporary splices of innerduct used for installation must withstand static air pressure of 110 psi.

Fiber installation equipment must incorporate a mechanical drive unit or pusher, which feeds cable into pressurized innerduct to provide a sufficient push force on cables, which is coupled with drag force created by the high-speed airflow. Units must be equipped with controls to regulate flow rates of compressed air entering ducts and hydraulic or pneumatic pressure applied to cables. Installation equipment must accommodate longitudinally ribbed, or smooth wall ducts from nominal 0.6 inch to 2 inches inner diameter. Mid assist or cascading of equipment must be used for installation of long cable runs. Installation equipment must be equipped with safety shutoff valves to disable the system in the event of sudden changes in pneumatic or hydraulic pressure.

Installation equipment must not require the use of pistons or other air capturing devices to impose a pulling force at the front end of cables that significantly restricts free flow of air through inner ducts. Installation equipment must use a counting device to determine the speed of cables during installation and lengths of cable installed.

## **SPLICING**

Field splices must be done in splice vaults, or cabinets, in splice trays housed in splice closures.

Fiber splices must be fusion type unless otherwise specified. Mean splice loss must not exceed 0.07 dB per splice and must be obtained by measuring loss through splices in both directions and averaging the resultant values.

Splices must be protected with a metal reinforced thermal shrink sleeve.

The mid-span access method must be used to access individual fibers in cables for splicing to other cables. Cable manufacturers recommended procedures and approved tools must be used for mid-span access. Only fibers to be spliced may be cut. Buffer tubes and individual fibers not being used in mid-span access must not be modified or damaged.

Individual fibers must be looped one full turn within splice trays to avoid micro bending. A 1.75 inch minimum bend radius must be maintained during installation and after final assembly in optical fiber splice trays. Bare fibers must be individually restrained in splice trays. Optical fibers in buffer tubes and placement of bare optical fibers in splice trays must not produce tensile force on optical fibers.

You will be allowed to splice a total of 30 percent of fibers to repair damage done during mid-span access splicing without penalty. The Engineer will assess a fine of \$300.00 for each additional and unplanned splice. A single fiber may not have more than 3 unplanned splices. If a fiber requires more than 3 unplanned splices, the entire length of F/O cable must be replaced at your expense.

## **SPLICE CLOSURES**

F/O field splices must be enclosed in splice closures, complete with splice organizer trays, brackets, clips, cable ties, seals and sealant, as needed. Splice closures must be suitable for direct burial or pull box applications. Manufacturer's installation instructions must be supplied to the Engineer prior to installation of splice closures. Location of splice closures must be where a splice is required as shown on the plans, where designated by the Engineer, or described in these special provisions.

Splice closures must conform to the following specifications:

- A. Non-filled thermoplastic case
- B. Rodent proof, waterproof, re-enterable and moisture proof
- C. Cable entry ports must accommodate 0.4 to one-inch diameter cables

- D. Multiple grounding straps
- E. Accommodate a minimum of 6 splice trays
- F. Suitable for "butt" or "through" cable entry configurations
- G. Place no stress on finished splices within splice trays

Splice closures must be bolted to side walls of splice vaults.

Verify the quality of splices prior to sealing splice closures. Splice closures must not be sealed until link testing is performed and is approved by the Engineer.

### **SPLICE TRAYS**

Splice trays must accommodate a minimum of 12 fusion splices and must allow a minimum bend radius of 1.75 inch. Individual fibers must be looped one full turn within splice trays to allow for future splicing. Stress must not be applied on fibers when located in final position. Buffer tubes must be secured near entrances of splice trays. Splice tray covers may be transparent.

Splice trays must conform to the following:

1. Accommodate up to 24 fusion splices
2. Place no stress on completed splices within the tray
3. Stackable with a snap-on hinge cover
4. Buffer tubes securable with channel straps
5. Accommodate a fusion splice with the addition of an alternative splice holder
6. Be labeled after splicing is completed.

Only one splice tray may be secured by a bolt through the center of the tray in fiber termination units. Multiple trays must be securely held in place per the manufacturer's recommendation.

### **PASSIVE CABLE ASSEMBLIES AND COMPONENTS**

F/O cable assemblies and components must be compatible components, manufactured by a company regularly engaged in the production of material for the fiber optic industry. Components or assemblies must be best quality, non-corroding.

### **FIBER OPTIC CABLE TERMINATIONS**

#### **General**

Cables must continue within conduit to the designated cable termination point. Components must be the size and type required for the specified fiber. Fiber optic cable terminations may take place in several locations such as data node, traffic signal, ramp metering system and CCTV camera locations.

#### **Cable Termination**

Once the fiber optic cable arrives within hubs, it must be routed within conduit to a wall mounted fiber splice closure as shown on the plans.

Fiber Optic Inside Plant (FOIP) cable must be spliced to incoming cable.

At the FDU and the C-MIC, the cable jacket of the FOIP, or outside plant cable, must be removed exposing the Aramid yarn, filler rods, and buffer tubes. The exposed length of buffer tubes must be at least the length recommended by the FDU manufacturer, which allows the tubes to be secured to the splice trays. Buffer tubes must be secured to splice trays in which they are to be spliced. The remainder of the tubes must be removed to expose sufficient length of fibers to properly install on splice trays, conforming to the requirements in "Splicing," of these special provisions

Factory terminated pigtails must be spliced and placed in splice trays.

Fibers inside fiber optic cables entering Fiber Distribution Units (FDU) must be terminated and labeled. Attention is directed to "Fiber Distribution Unit" of these special provisions.

A transition must be made with flexible tubing to isolate fibers and protect individual coated fibers. The final transition from bundle to individual fiber tube must be secured with an adhesive heat shrink sleeve. Attention is directed to Fan-Out Termination, of these special provisions.

### Distribution Interconnect Package

Distribution involves connecting fibers to locations shown on the plans. The distribution interconnect package consists of FDFs, C-MICs and FDU with connector panels, couplers, splice trays, fiber optic pigtails and cable assemblies with connectors. The distribution interconnect package must be assembled and tested by a company regularly engaged in the assembly of these packages. Attention is directed to "Fiber Optic Testing" of these special provisions. Distribution components must be products of same manufacturers, regularly engaged in the production of these components with quality assurance programs.

### Fiber Optic Cable Assemblies and Pigtails

Cables for cable assemblies must be made of fiber meeting the performance requirements of these special provisions for the F/O cable being connected.

Pigtails must be of simplex (one fiber) construction, in 35-mil tight buffer form, surrounded by Aramid yarn for strength, with a PVC jacket with manufacturer's identification information, and a nominal outer jacket diameter of 118 mil. Singlemode simplex cable jackets must be yellow. Pigtails must be factory terminated and tested and at least one meter in length.

Jumpers may be of simplex or duplex design. Duplex jumpers must be duplex round cable construction and must not have zipcord (Siamese) construction. Jumpers must be at least 6 feet in length.

Outer jackets of duplex jumpers must be yellow. The 2 inner simplex jackets must be contrasting colors to provide easy visual identification for polarity.

Connectors must be ceramic ferrule ST type for SMFO. Indoor ST connector body housings must be nickel-plated zinc or glass reinforced polymer construction. Outdoor ST connector body housings must be glass reinforced polymer.

Associated couplers must be the same material as connector housings.

F/O connectors must be the 0.1-inch connector ferrule type with Zirconia Ceramic material with a PC (Physical Contact) pre-radiused tip.

ST connector operating temperature range must be from -40 to +165 °F. Insertion loss must not exceed 0.4 dB for singlemode and return reflection loss on singlemode connectors must be at least -35 dB. Connection durability must be less than a 0.2 dB change per 500 mating cycles per EIA-455-21A (FOTP-21). Terminations must provide a minimum 50 pounds pull out strength. Factory test results must be documented and submitted to the Engineer prior to installing connectors. Singlemode connectors must have a yellow color on the body and boot.

Field terminations must be limited to splicing of adjoining cable ends and cables to ST pigtails.

Connectors must be factory-installed and tested.

Unmated connectors must have protective caps installed.

### Fiber Distribution Unit

You must install components to terminate incoming fiber optic communication cables.

FDU Type	Accommodates Termination of
E	12SMFO
H	48SMFO

Fiber distribution units (FDU) must include the following:

1. Patch panels to terminate the appropriate number of singlemode fibers with ST type connectors feed through couplers.
2. Splice trays.
3. Storage for splice trays.
4. A slide out metal drawer for storage of spare jumpers.

Strain relief must be provided for incoming fiber optic cables. Cable accesses must have rubber grommets or similar material to prevent cables from contacting bare metal. Fibers must be terminated and individually identified in FDUs and on patch panels.

Patch panels must be hinged or have coupler plates to provide easy access and maintenance. Brackets must be provided to spool incoming fibers a minimum of 2 turns. Turns must not be less than 12 inches before separating out individual fibers to splice trays.

FDUs must be 19-inch rack mountable.

FDUs must not exceed 10 inches in height and 15 inches in depth.

Termination and distribution cable trays must accommodate 12 and 48 singlemode fiber optic cables, and must have sufficient tray areas for excess optical fiber storage with provisions to assure that optical fibers do not exceed a 2-inch bend radius. Termination and distribution cable tray assemblies must include a designation strip for identification of 12 and 48 singlemode optical fibers, splice drawers must include 2 splice trays with an individual splice tray capable of accommodating 12 and 48 fusion type splices. Splice drawers must allow storage of excess lengths of optical fibers of fiber optic cables. Fiber distribution units must be provided with cable clamps to secure fiber optic cables to the chassis.

Fibers must be labeled in the splice tray with permanent vinyl markers. Fiber bonds must be labeled to identify the physical designation of each individual fiber strand

### **Installation**

Optical fibers must be of appropriate lengths to allow future splicing with splice drawers and must be appropriately identified. Splices must be fusion type and must be arranged within splice trays of fiber distribution units in accordance with the organizational design of splice trays. Appropriate protective coatings must be applied to fusion splices.

### **Payment**

Full compensation for fiber distribution unit must be considered as included in the contract prices paid for the items requiring fiber distribution unit and no separate payment will be made therefor.

## **FIBER OPTIC TESTING**

### **General**

Documentation for testing conducted at the manufacturer's premises must be submitted to the Engineer when the equipment is delivered to the site.

For field testing, provide personnel, equipment, instrumentation, and materials necessary to perform testing. The Engineer must be notified 2 working days prior to field tests. Notification must include the exact location or portion of system to be tested.

Documentation of field testing results must be provided to the Engineer within 2 working days after testing.

A minimum of 15 working days prior to arrival of cable at the site, you must provide detailed test procedures for field testing for the Engineer's review and approval. Procedures must include tests involved and how tests are to be conducted. Test procedures must include the model, manufacturer, configuration, calibration, and alignment procedures for proposed test equipment.

### **Factory Testing**

Documentation of compliance with fiber specifications as listed in the Fiber Characteristics Table must be supplied by the original equipment manufacturer. Before shipment, but while on shipping reels, 100 percent of fibers must be tested for attenuation. Copies of the results must be maintained on file by the manufacturer with a file identification number for a minimum of 7 years, attached to cable reels in waterproof pouches, and submitted to you and to the Engineer.

### **Arrival On Site**

Cables and reels must be physically inspected on delivery and 100 percent of fibers must be attenuation tested to confirm that cable meets requirements. Failure of a fiber in the cable must be cause for rejection of the entire reel. Test results must be recorded, dated, compared and filed with copies accompanying shipping reels in weatherproof envelopes. Attenuation deviations from shipping records of greater than 5 percent must be brought to the attention of the Engineer. Cables must not be installed until completion of testing and written approval of the Engineer. Copies of traces and test results must be submitted to the Engineer. If test results are unsatisfactory, the reel of F/O cable must be considered unacceptable and records corresponding to that reel of cable must be marked accordingly. Unsatisfactory reels of cable must be replaced with new reels of cable at your expense. New reels of cable must be tested to demonstrate acceptability. Copies of test results must be submitted to the Engineer.

### **After Cable Installation**

Index matching gel will not be allowed in connectors during testing. After fiber optic cable has been pulled, but before breakout and termination, 100 percent of fibers must be tested with an OTDR for attenuation. Test results must be recorded, dated, compared, and filed with previous copies of these tests. Copies of traces and test results must be submitted to the Engineer. If OTDR test results are unsatisfactory, the F/O cable segment of cable will be rejected. Unsatisfactory segments of cable must be replaced with new segments, without additional splices, at your expense. New cable segments must be tested to demonstrate acceptability. Copies of test results must be submitted to the Engineer.

## **System Cable Verification At Completion**

### **Power Meter and Light Source**

At the conclusion of OTDR testing, 100 percent of fiber links must be tested end-to-end with a power meter and light source, in accordance with EIA Optical Test Procedure 171 and in the same wavelengths specified for OTDR tests. Tests must be conducted in one direction. As shown in Appendix A, the Insertion Loss (IC) must be calculated. Test results must be recorded, compared, and filed with the other recordings of the same links. Test results must be submitted to the Engineer. These values must be recorded in the Cable Verification Worksheet in Appendix A.

### **OTDR Testing**

After passive cabling systems have been installed and are ready for activation, 100 percent of fibers must be tested with OTDR for attenuation at wavelengths from 1310 to 1550 nm. OTDR testing must be performed in both directions (bi-directional) on fibers. Test results must be generated from software of test equipment, recorded, dated, compared and filed with previous copies. A hard copy printout and an electronic copy on a CD of traces and test results must be submitted to the Engineer. The average of the 2 losses must be calculated and recorded in the Cable Verification Worksheet in Appendix A. The OTDR must be capable of recording and displaying anomalies of at least 0.02 dB. Connector losses must be displayed on OTDR traces.

### **Cable Verification Worksheet**

The Cable Verification Worksheet shown in Appendix A must be completed for links in fiber optic systems using data gathered during cable verification. Completed worksheets must be included as part of system documentation.

### **Test Failures**

If link loss, measured from the power meter and light source, exceeds the calculated link loss or the actual location of fiber ends does not agree with the expected location of fiber ends, fiber optic links will not be accepted. Unsatisfactory segments of cable or splices must be replaced with new segments of cables or splices at your expense. OTDR testing, power meter and light source testing, and Cable Verification Worksheet must be completed for repaired links to determine acceptability. Copies of test results must be submitted to the Engineer. Removal and replacement of segments of cable must be considered as removal and replacement of a single contiguous length of cable connecting 2 splices and 2 connectors. Removal of a section containing a failure will not be allowed.

### **Passive Component Package Testing and Documentation**

Components in the passive component package (FDUs, pigtails, jumpers, couplers, and splice trays) must be from a manufacturer who is ISO 9001 registered.

Pigtails or jumpers must be tested for insertion attenuation loss using optical power meters and light sources. Singlemode terminations must be tested for return reflection loss. Values must meet loss requirements specified and must be recorded on tags attached to pigtails or jumpers.

After an assembly is complete, you must visually verify that tagging of loss values is complete. The manufacturer must conduct an "end-to-end" optical power meter/light source test from pigtail ends to end of terminating points assuring continuity and overall attenuation loss values are acceptable.

Final test results must be recorded with previous individual component values on forms assigned to individual FDU or C-MIC. Completed forms must be dated and signed by the Manufacturer's Quality Control supervisor. One copy of the form must be attached in a plastic envelope to the assembled FDU or C-MIC unit. Copies must be provided separately to the Contractor and the Engineer, and must be maintained on file by the manufacturer or supplier for a minimum of 7 years.

Assembled and completed FDU or C-MIC units must be protectively packaged for shipment to you for installation.

### **Fiber Optic System Performance Margin Design Criteria**

Installed system performance margin must be at least 6 dB for links. If the design system performance margin is less than 6 dB, the Engineer must be notified of your plan to meet this requirement.

### **Active Component Testing**

Transmitters and receivers must be tested with power meters and light sources to record transmitter average output power (dBm) and receiver sensitivity (dBm). Values must be recorded in the Fiber System Performance Margin Calculations Worksheet in Appendix B, section C, number 6.

**APPENDIX A**

**Cable Verification Worksheet**

*End-to-End Attenuation (Power Meter and Light Source) Testing  
and OTDR Testing*

Contract No. \_\_\_\_\_ Contractor: \_\_\_\_\_

Operator: \_\_\_\_\_ Date: \_\_\_\_\_

Link Number: \_\_\_\_\_ Fiber Number: \_\_\_\_\_

Test Wavelength (Circle one): 1310 nm      1550 nm

Expected Location of fiber ends: End 1: \_\_\_\_\_ End 2: \_\_\_\_\_

**Power Meter and Light Source Test Results:**

Power In:	_____ dBm	1A
Output Power:	_____ dBm	1B
Insertion Loss [1A - 1B]:	_____ dB	1C

**OTDR Test Results:**

Forward Loss:	_____ dB	2A
Reverse Loss:	_____ dB	2B
Average Loss [(2A + 2B)/2]:	_____ dB	2C

-----  
To Be Completed by Caltrans:

Resident Engineer's Signature: \_\_\_\_\_

Cable Link Accepted: \_\_\_\_\_

**APPENDIX B**  
**Fiber System Performance Margin Calculations Worksheet**

**A. Calculate the Passive Cable Attenuation**

1. Calculate Fiber Loss at Operating Wavelength: _____ nm	Cable Distance (times) Individual Fiber Loss (equal) @ 1310 nm (0.6 dB/mi) @ 1550 nm (0.5 dB/mi)	_____ mi x ____ dB/mi =
<b>Total Fiber Loss:</b>		_____ dB

**B. Calculate the Total Connector/Splice Loss**

2. Calculate Connectors/couplers Loss: (exclude Tx and Rx connectors)	Individual Connector Loss (times) Number of Connector Pairs (equal) <b>Total Connector Loss:</b>	0.4 dB x _____ = _____ dB
3. Calculate Splice Loss:	Individual Splice Loss (times) Number of Splices (equal) <b>Total Splice Loss:</b>	0.1 dB x _____ = _____ dB
4. Calculate Other Components Loss:	<b>Total Components:</b>	_____ dB
5. Calculate Total Losses:	Total Connector Loss (plus) Total Splice Loss (plus) Total Components (equal)	+ dB + dB + dB =
<b>Total Connector/Splice Loss:</b>		_____ dB

**C. Calculate Active Component Link Loss Budget**

System Wavelength:		_____ nm
Fiber Type:		singlemode
Average Transmitter Output (Launch Power):		_____ dBm
Receiver MAX Sensitivity ( $10^9$ BER) (minus)		_____ dBm
Receiver MIN Sensitivity (equal)		- _____ dBm = _____ dB
<b>Receiver Dynamic Range:</b>		
6. Calculate Active Component Link Loss Budget:	Average Transmitter Output (Launch Power) (minus)	_____ dBm
	Receiver MAX Sensitivity (equal)	- _____ dBm = _____ dB
<b>Active Component Link Loss Budget:</b>		_____ dB

**D. Verify Performance**

7. Calculate System Performance Margin to Verify Adequate Power:	Active Component Link Loss Budget [C] (minus)	_____ dB
	Passive Cable Attenuation [A] (minus)	- _____ dB
	Total Connector/Splice Lost [B] (equal)	- _____ dB = _____ dB
<b>System Performance Margin:</b>		_____ dB

**FIBER OPTIC TRAFFIC MODEM**

Fiber optic traffic modem (FOTM) must operate asynchronously with a serial EIA-232 compatible interface with Tx data, Rx data, DCD, RTS, CTS, and signal ground interface lines.

The FOTM must have the following configuration:

1. The modem must be configured to be used in a polled multi-drop fiber optic daisy-chained system.
2. The modem must use standard FSK modulation for data rates from 0 to 1200-baud data rates.
3. There must be 2 fiber optic interfaces, primary and secondary. DCD must be asserted for a Rx data carrier on either fiber optic interface. Rx data from the primary interface will be placed on the Rx data line of the EIA-232 interface. The presence of DCD must inhibit the generation of CTS in response to RTS, otherwise the modem must generate RTS within 8 ms. When RTS is asserted Tx data will be sent on the primary fiber optic interface. Duplicating TX data to the secondary fiber optic interface must be switch selectable. Rx data on the primary fiber optic interface must be retransmitted on the secondary fiber optic interface. Rx data on the secondary fiber optic interface must be retransmitted on the primary fiber optic interface.
4. The modem may have a switch selection to copy Rx data on the secondary fiber optic interface to the EIA-232 interface. The fiber optic transmitters must have a launch power of not less than -8 dBm into standard singlemode fiber optic cables.
5. The modem must use ST connectors. The fiber optic operating wavelength must be 1310 nm. The EIA-232 interface must use a standard DB-25 connector.
6. The modem must have a optical power budget of 15 dB with an error rate less than  $1$  in  $10^8$ .
7. The modem must have a bridging audio port with the ability to connect to Caltrans Model 400 modems to bridge to multiple nearby controllers and receive polls for them and transmit their data for them.

**10-3.22 CLOSED CIRCUIT TELEVISION CAMERA LOCATION**

Closed circuit television (CCTV) camera at various locations must consist of providing and installing electrical service, CCTV camera assemblies, including camera control circuits and accessories, pan and tilt units, digital signal processing (DSP) color video cameras, camera lenses and camera housings, CCTV wiring, including composite video cables for video and camera controls, connectors and coaxial cables, Model 334-TV controller cabinets on new foundations, including local patch panels (LPPs), video transmitters, fiber optic control modems (FOCMs) and connecting wires and cables, camera poles, sign truss mounts where required and other required equipment, as shown on the plans and as directed by the Engineer.

Communication conduits, communication pull boxes, fiber optic cable and fiber distribution unit are specified in "Communication System" of these special provisions.

CCTV locations that coincide with video nodes may omit video transmitters in video nodes by routing video coaxial cables to video multiplexers in video nodes, as shown on the plans.

Test equipment prior to installation to verify that it functions in accordance with the manufacturer's specifications.

After installation, CCTV camera equipment must be tested in conformance with the requirements of "System Testing and Documentation" of these special provisions.

#### **CLOSED CIRCUIT TELEVISION EQUIPMENT**

Equipment racks must be industrial grade and must conform to EIA-310.

Rack mounted equipment and card cage assemblies must have metal filler plates to cover unused channel slots or card slots.

Equipment must be current standard production units and must have been in production for a minimum of 6 months.

The Contractor must arrange, at the Contractor's expense, to have a technician qualified to work on CCTV equipment and employed by the manufacturer or the manufacturer's representative, present when equipment is turned on.

#### **CLOSED CIRCUIT TELEVISION CAMERA ASSEMBLY**

Closed circuit television (CCTV) camera assembly must consist of installing the following:

1. A CCTV camera assembly on pole,
2. Camera control circuits and accessories,
3. CCTV wiring, including composite video cables, connectors and coaxial cables,
4. and other required incidental equipment, complete in place, as shown on plans and as directed by the Engineer, to provide a fully functional location as shown on the plans.

The CCTV camera assembly must be supplied as a fully-assembled, integrated, tested and configured single unit from the manufacturer at the camera manufacturer facility and must be delivered to the project site accompanied with a written certification of assembly and configuration from the camera manufacturer. This certification must serve as the manufacturer documentation that the assembly and configuration of the camera/lens/housing equipment were performed. A sample certification document must be furnished as part of the materials submittal data to the Engineer.

#### **CCTV Camera Assembly Communications Specifications:**

1. Serial data communications ports conforming to EIA/TIA-232 and EIA/TIA-422
2. Configurable to support both NTCIP 1205 v01.08- NTCIP Objects and existing protocols for CCTV camera control used in the Los Angeles Regional Traffic Management Center (LARTMC).
3. Via the CCTV protocol, the user must be able to obtain camera position information including tilt angles, pan positions and zoom levels. The information must be supplied as from 0 to 359 degrees azimuth and from -95 to +95 degree elevation.
4. TCP/IP 100 Base T Fast Ethernet data communication port

#### **CCTV Camera Assembly Installation**

Before installation and after installation, the Contractor must test to verify that all new CCTV camera assembly equipment functions in accordance with the manufacturer's specifications. After installation, new CCTV camera equipment must be tested at each individual location described under "System Testing and Documentation," in these special provisions.

Install and fully adjust the CCTV camera assembly with the associated components, power supply, housing, and all necessary cabling and incidental equipment to make the CCTV camera assembly completely operational. The CCTV camera assembly components must be fully interchangeable.

Supply all of the required mounting brackets, adapters, bolts, nuts, screws and other components to fully install and firmly attach the CCTV camera assembly on camera pole Type 45. Exercise care to tighten the CCTV camera assembly mount within the torque limits specified by the camera manufacturer.

Secure the electrical cables inside the housing and cabinet so that they do not interfere with the closing of the cabinet, the fan or any other moving part.

Verify that the camera lens in the housing enclosure is centered in the optical window.

Adjust the back-focus adjustment on the camera such that the lens focus is properly set and maintained over the zoom range. This adjustment must be made such that when the zoom is adjusted from long range (telephoto) to wide angle that in refocusing is necessary.

The CCTV camera assembly must operate reliably under a full range of environmental and lighting conditions and must provide clear and usable images. The CCTV camera assembly must be protected from brown outs and voltage spikes up to 1000 V.

### Composite Video Cable

Composite video cable must consist of a single composite cable containing coax, power, and 2 sets of control conductors (DB-9 and RJ-45). The single-jacket cable must be able to transport video, power, and data control up to 750 feet and as recommended by the CCTV camera manufacturer.

The composite video cable must be compatible with the camera assembly and the various camera control equipment housed inside the Model 334-TV controller cabinet and must be configured to make the CCTV sub-system completely operational.

The composite video cable must run continuously between terminations without splices.

Specifications of all cables, cable assemblies, and connectors with strain relief backshells intended for use must be submitted to the Engineer as part of the shop drawings for review and approval. Test all composite video cables for continuity prior to and after installation.

Each conductor in the composite video cable must be insulated with a polypropylene jacket, color coded for positive identification, must be rated for outdoor usage, and as approved by the Engineer.

### Closed Circuit Television Camera

The CCTV camera must consist of a Digital Signal Processing (DSP) color video camera unit, camera zoom lens, enclosed camera control cables and connectors, environmental camera housing, and pan and tilt unit.

#### Physical specifications

The maximum overall weight of the CCTV camera assembly including pan and tilt unit must be less than 20 pounds.

The maximum overall dimensions of the camera assembly including pan and tilt unit must be less than 12" (H) x 14" (W) x 7" (D).

#### Shock/Vibration Specifications

The CCTV camera assembly must meet the following shock and vibration specifications:

Shock	Conforms to NEMA TS2, paragraph 2.1.10, 2.2.4
Vibration	Conforms to NEMA TS2, paragraph 2.1.9, 2.2.3

The CCTV camera assembly must not incur any physical damage after a shock, must return to normal operation immediately, and must operate within the specified vibration.

### DSP Color Video Camera Unit

The DSP color video camera must operate reliably under a full range of environmental and lighting conditions, must provide clear and usable images and must be fully interchangeable.

The DSP color video camera must be of solid state design, and must meet the following configuration requirements:

A. Performance.--The following are the performance specifications for the camera:

Optical device	Color CD interline transfer, NTSC
Optical device size	0.25inch
Pixels	35X Lens & Electronic Image Stabilization (EIS): 768 (horizon.) x 494 (vertical) Min.
Horizontal resolution	35X Lens & EIS: 520 television lines Min
Sensitivity (scene) using 35X Lens & EIS	0.1 fc at 1/60 sec. (color day) 0.01 fc at 1/4 sec. (color day) 0.001 fc at 1/4 sec. (mono night)
Scanning	Progressive scan at 35X Lens & EIS
Back focus adjustment	Required
Frame frequency (FPS selectable)	30, 15, 8, 4, 2 and 1 FPS
Width to height aspect ratio	4:3

The system must be capable of providing clear, low-bloom and low-lag video pictures under all conditions from bright sunlight to nighttime scene illumination. White balance must meet the following:

1. Auto: Color quality must be maintained by a continuous through the lens automatic white balance system for color temperatures from 2850K to greater than 5100K with less than 10 IRE units unbalance
  2. Set: Allows user to set white as preferred. For instance, the camera could be focused on an Off White scene and Set to white balance. The camera will then automatically track color temperature changes, biasing the auto white balance on the Off White instead of the factory-defined white
  3. Lock: Locks the white balance at the current levels
  4. Indoor: Sets the White to be consistent with 3200K
  5. Outdoor: Sets the White to be consistent with 5100K
  6. Fluorescent: Sets the White to be consistent with fluorescent lighting
- B. Electrical Specifications.--The following are the electrical specifications for the camera:

Operating voltage	115 V(ac). at 50/60 Hz. (±10%)
Heater Power Input Requirements	115 V(ac) at 50/60 Hz. (±10%)
Power Consumption	7 W with Heater Off; 12 W with Heater On
Power Interruption	Conforms to NEMA TS2 paragraph 2.1.4
Power Transients/Interruptions	Conforms to NEMA TS2 paragraph 2.1.6
EMI	FCC rules, Part 15, subpart J, for Class B devices
Video output signal	Standard NTSC color TV
Motorized-Iris connector	Required
Gamma	0.45
Sensitivity (3200K):	
Full Video, AGE off, iris at f/1.6, shutter at 1/60:	11 fc scene illumination (0.85 fc faceplate illum.)
80% Video, AGE on:, Iris at f/1.6, shutter at 1/60 :	1 fc scene illumination (0.08 fc faceplate illum.)
30% Video, AGE on, Iris at f/1.6, shutter at 1/60:	0.2 fc scene illumination (0.016 fc faceplate illum.)
30% Video, AGE on, 1/4-second integration:	0.0125 fc scene illumination (0.001 fc faceplate illum.)
	Note 1: Scene Illumination is based on 100% reflectance.
Video output connector	Standard BNC bulkhead on rear of camera
Imager	Interline transfer micro-lens CD with mosaic-type color compensating filter.
Resolution	460 horizontal; 350 vertical- NTSC
Digital Zoom Range	Auto/Manual (12X)
Lens Zoom	35X Lens & EIS: 0.14" to 4.7" f1.4 (w) f4.2 (t)
Horizontal Angle of View	35X Lens & EIS: 55.8 degrees (w) 1.7 degrees (t)
Iris/Focus/Shutter Operation	Auto/Manual
Minimum Focus Distance	0.4" at Max. wide; 40" at Max tele
Auto Focus	Selectable Auto/Manual. Minimum Scene Illumination for Reliable Auto Focus, 30% video
Zoom & Focus Presets	64 preset positions (Note: recalling a preset position puts camera into manual focus mode)
Long Term Integration Range	Provides manual selection of integration duration for enhanced sensitivity. Integration times are 1/4 second, 1/8 second, 1/15 second, 1/30 second. Frame Store video output provides continuous video output, updated at the integration rate.
Signal to noise ratio	>50 dB
Synchronization	Internal Crystal/Phase sync or adjust line lock
Video output level	1.0 V p-p (75 ohms composite), unbalanced, NTSC
Gain control	Automatic
Automatic white balance	Required
Title Generation	2 lines of 24 characters each for camera ID; Preset ID, sector ID, privacy zone; Low pressure alarm, temperature readout, pressure readout
Alarm Messages	Automatically generated by the camera, pop up on the screen to alert user
Camera Control ID	Selectable from 001 to 999 Min.
Camera Position after power interruption	Camera shall return to previous position and state of operation upon power interruption and restoration

Provide the camera with a suitable power supply that operates with an AC input voltage.

The camera must have automatic gain control (AGC) from 0 to 16 dB in order to be able to handle the range of lighting extremes from very low light night scenes to full sunlight conditions. If the AGC control is switchable, the Contractor must set the AGC to the "on" position.

The camera must be equipped with an electronic shutter with adjustable speeds. Manual Shutter: Selectable shutter speeds of 1/60, 1/100; 1/250; 1/500; 1/1,000; 1/2,000; 1/4,000; 1/10,000, and 1/30,000 second. Auto Shutter: Automatically controls shutter speed between 1/60 and 1/30,000 second to maintain correct video level output. Auto Iris: Iris automatically adjusts to compensate for changes in scene illumination to maintain constant video level output within sensitivity specifications. Manual Iris: In the manual iris mode the iris opens and closes in steps.

The Contractor must set the shutter speed of the camera at 1/60th of a second.

C. Physical Specifications.--The following are the physical specifications for the camera:

Maximum weight	18 pounds
Maximum dimensions	11.4" (H) x 13.3" (W) x 6.8" (D) (body)

D. Environmental Specifications.--The following are the environmental specifications for the camera:

Operating temperature	From -30 to 165 °F
Storage temperature	From -40 to 165 °F
Operating humidity	Up to 100% relative humidity
Storage humidity	Conforms to NEMA TS2 paragraph 2.1.5.1
Shock	Conforms to NEMA TS2, paragraph 2.1.10
Protection rating	NEMA 4X
Housing Protection	Sealed and pressurized with 5 pound/sq. inch dry nitrogen with Schraeder purge fitting and 20 pound/sq. inch relief valve

The CCTV camera must not incur any physical damage after a shock, return to normal operation immediately, and operate within the specified vibration.

Provide operation and maintenance manuals for the DSP color video camera, as described under "System Testing and Documentation" in these special provisions.

**CCTV CAMERA LENS**

The CCTV camera lens must work properly in conjunction with the camera as well as all of the other video system components. It must operate reliably and produce clear images when properly adjusted and meet the following specifications.

The CCTV camera lens must be an integral component of the CCTV camera. The lens must be factory assembled, back-focused, and adjusted during manufacturing of the camera. Separate camera and lens combinations will not be accepted. The camera lens must provide auto iris with manual iris over-ride capabilities.

The following are the specifications for the lens:

Iris type	Motorized iris
Iris position without power	Closed
Operating temperature	From 30 to +165 °F (Min. range).
Storage temperature	From -40 to 165 °F
Operating humidity	From 20 to 80% non-condensing
Storage humidity	From 20 to 90% non-condensing

When the camera is pointed at a very bright object or when the camera and lens is first turned on, the image produced by the lens and camera combination should not optically "oscillate" (i.e., produce an image that alternates from too light to too dark) or otherwise be unstable. The lens and camera combination should react to temporary overload situations (such as described above) in a smooth and rapid fashion and with minimum overshoot.

The following are the optical specifications for the lens:

1. When the power is removed from the lens, the lens iris must automatically close
2. The lens must incorporate an integral variable-density filter
3. The lens must include mechanical and electrical means to protect the motors from over running in the extreme position

The lens must be supplied with zoom and focus in preset position. Provide operation and maintenance manuals for the lens as described under System Testing and Documentation" in these special provisions.

**CCTV CAMERA ASSEMBLY HOUSING**

The CCTV camera Assembly housing must protect the CCTV camera and camera lens from rain, dust, wind and other elements. The housing must be corrosion resistant, tamperproof sealed and pressurized. The camera housing must include a loss of pressure sensor that will trigger an alarm message, which will be inserted in the video output signal.

The housing exterior must be finished by pre-treatment with a conversion coating and baked enamel paint and must be designed to withstand the effects of hose-directed water, rain, sand, dust, and other adverse environmental conditions. All connections must be watertight. A gas-tight connector must be used at the rear plate of the housing. Wiring to the connector must be sealed with silicon or potting compound.

The internal humidity of the housing must be less than 10 percent, when sealed and pressurized. Desiccant packs must be securely placed inside the housing to absorb any residual moisture and maintain internal humidity at 10 percent or less. The viewing window must allow unrestricted camera views can be obtained at all camera and lens positions and the lens in the center of the housing window. The camera housing must not incur any physical damage after a shock, return to normal operation immediately, and operate within the specified vibration.

Provide any adapter plates required to mount positioning system to pole.

**DIGITAL VIDEO REQUIREMENTS**

The following are the digital video requirements:

Video Encoding	MPEG 4 SP/H.264
Resolution	640 x 480 (VGA); 640 x 240 (ACIF); 320 x 240 (CIF)
Frame Rates	30/15/8/4/2/1 per second selectable
Video Latency	<200ms
Bit Rates	Constant: 3 Mbps maximum Variable: 8 Mbps maximum

**BUILT-IN PAN AND TILT UNIT**

The pan and tilt unit will be built-in with camera assembly unit with any electrical or communication interfaces required to perform the functions specified. The built-in pan and tilt unit must operate reliably for the warranty period with little or no maintenance, be environment and weather-resistant under a full range of environmental conditions, and provide repeatable day-to-day operation.

**Performance Specifications:**

The built-in pan and tilt unit must meet the following performance specifications:

Braking: Pan and Tilt	Mechanical or Electrical to limit coasting
Overload Protection	Motors: Impedance protected
Construction	Corrosion resistant steel or aluminum
Angular Travel	Pan: 360 degrees continuous Tilt: At least -90 to +90 degrees
Motor Reversal	Immediate

The built-in pan and tilt with camera assembly unit must be able to withstand a wind load of 100 mph.

**Electrical Specifications**

The built-in pan and tilt unit must meet the following specifications:

Power requirements	From 108 to 132 V(ac), 50/60 HZ ±3%
Duty cycle	Pan: continuous Tilt: intermittent
Pan and Tilt position preset	Minimum of 16 preset positions. Enables preset position to a predetermined Azimuth, elevation and lens position

### Physical specifications

The built-in pan and tilt unit must meet the following physical specifications:

Maximum weight	18 pounds
Maximum dimensions	11.4" (H) x 13.3" (W) x 6.8" (D) (body)
Pan Speed (manual)	From 0.1 to >80 degrees/sec (operator control)
Pan Speed (preset)	120 degrees/second
Tilt Speed (manual)	From 0.1 to > 4 degrees/sec (variable - operator control)
Tilt Speed (preset)	120 degrees/second
Mounting (Base)	7" + 0.12"
Camera Mount	Compatible with camera housing
Preset Accuracy	0.1 degree
Privacy Zones	8 programmable zones can be set for video blanking

### Shock/Vibration Specifications

The built-in pan and tilt unit must meet the following vibration specifications:

Shock	Up to 5gs
Vibration	Conforms to NEMA TS2, para. 2.1.9, 2.2.3

The built-in pan and tilt unit must not incur any physical damage after a shock, must return to normal operation immediately, and must operate within the specified vibration.

### Environmental Specifications

The built-in pan and tilt unit must meet the following environmental specifications:

Operating temperature	From -30 to + 165 °F
Finish	Weather resistant paint or polyurethane

### Pan and Tilt Stops

The built-in pan and tilt unit must have pan and tilt stops. The setting must be determined by the Engineer. Pan and tilt stops must have both mechanical and electrical stops.

### Built-in Pan and Tilt Unit Installation

The Engineer will notify the Contractor of the pan and tilt stops for the built-in pan and tilt unit for the Contractor to set, prior to installation check. Installation check must be done in the presence of the Engineer. The operation of the built-in pan and tilt unit will be performed at the Model 334-TV controller. Furnish a laptop with software, for testing only, to view the actual camera. The Engineer will direct adjustments for pan and tilt presets and pan and tilt stops, to be made by the Contractor. Upon completion of the installation, the Engineer will verify operation of the pan and tilt unit.

Provide operation and maintenance manuals for the pan and tilt unit, as described under "System Testing and Documentation" in these special provisions.

### CCTV CAMERA EQUIPMENT WARRANTY

All CCTV camera equipment installed must be warranted for a minimum of one year from time of final acceptance test, or 2 years from date of delivery, whichever is longer. The period of warranty coverage must not be less than the manufacturer's warranty period.

### MODEL 334-TV CONTROLLER CABINETS

The Model 334-TV controller cabinets must conform to the provisions in Section 86-3.01, "Controller Assemblies," of the Standard Specifications and these special provisions.

Cabinets must consist of a housing (A), a mounting cage 1, and the following listed equipment.

1. Service panel No. 1
2. Power distribution assembly
3. Input file
5. C1 harness
6. Controller and equipment shelves
7. Dual fan assembly with thermostatic control

Police panels will not be required.

Prior to shipping to the project site, each Model 334-TV controller cabinet must be submitted to the Transportation Laboratory for acceptance testing.

The Engineer must be notified when each Model 334-TV controller cabinet is ready for the functional test. The functional test will be conducted by State forces. Following two failed attempts, you must replace the failed cabinet with a new cabinet.

Delays resulting from submittal of non-compliant materials do not relieve you from executing the contract within the allotted time. Non-compliant materials will be rejected. You must resubmit new cabinet for retesting and pick up the failed units within 7 days of notification. You must provide new cabinets and allow a minimum of 30 days for the retest. You must pay for all shipping and handling costs related to testing and retesting. Delays resulting from resubmittal and retesting are your responsibility and no extra time will be allowed.

The following equipment must be provided with each power distribution assembly:

1. Two each of Duplex NEMA 5-20R controller receptacle
2. One each of 30 A, 1-pole, 120 V(ac) Main circuit breaker
3. One each of 15 A, 1- pole, 120 V(ac) circuit breaker
4. Two each of 20 A, 1- pole, 120 V(ac) circuit breaker

Three shelves must be furnished as shown on the plans. Each shelf must be attached to the tops of 2 supporting angles with 4 screws. Supporting angles must extend from the front to the back rails. The front of the shelf must abut the front member of the mounting cage. The shelves must be arranged as shown on the plans. The angles must be designed to support a minimum of 50 pounds each. The horizontal side of each angle must be a minimum of 3 inches. The angles must be vertically adjustable.

Three terminal blocks must be furnished as shown on the plans. Terminal blocks must conform to the requirements in Chapter 6 of the TEES, except that the screw size must be 8-32.

A maintenance manual must be furnished for all controller units, auxiliary equipment, vehicle detector sensor units, control units, and amplifiers. The maintenance and operation manuals may be combined into one manual. The maintenance manual or combined maintenance and operation manual must be submitted at the time the controllers are delivered for testing or, if ordered by the Engineer, before purchasing. The maintenance manual must include the following:

1. Specifications
2. Design characteristics
3. General operation theory
4. Function of all controls
5. Trouble shooting procedure (diagnostic routine)
6. Block circuit diagram
7. Geographical layout of components
8. Schematic diagrams
9. List of replaceable component parts with stock numbers

### **LOCAL PATCH PANEL**

Install a local patch panel (LPP) with each CCTV camera assembly. The local patch panel must be installed in the Model 334 TV cabinets to act as a local camera control point for the CCTV camera pan, tilt, zoom, focus and iris control functions.

The LPP must connect directly to the camera assembly and other communication devices such as the fiber optic modems or standard 9600 bps analog modems. The CCTV camera assembly cabling must be connected to the rear side of the LPP. The LPP must have standard NTSC BNC video jacks to allow connections to the CCTV camera and external video monitors to allow for viewing of the camera video from the CCTV cabinet.

Provide copies of the camera control software that can be operated from any laptop running Microsoft Windows 2000 or later. The camera control software must provide the necessary control, configuration and testing functions to completely operate, test and configure the CCTV cameras via the EIA-422 or RJ-45 ports on the unit. The laptop must be used to connect to the camera unit and control a full range of functions including the setting of its address.

### Front Panel

The LPP must be supplied with DB9 EIA-422 and RJ-45 connector for host connection to the CCTV assembly. The EIA-422 port and RJ-45 port for local PC connection must be on the front of the unit. The local EIA-422 port on the front of the patch panel must act as a 9600 baud local connection point for testing various functions and protocols and to setup and test the camera. A video BNC out option must also be present to supply video for a local monitor during setup and testing of a camera. Using the EIA-422 or RJ-45 connection ports on the LPP via a laptop must allow control of CCTV camera assemblies using NTCIP 1205 v01.08- NTCIP Objects and existing protocols for CCTV Camera Control used in the Los Angeles Regional Traffic Management Center (LARTMC).

### Rear Panel

Terminate the CCTV cable assembly to the rear of the LPP inside the Model 334-TV cabinet. The LPP must have a BNC video input connection for interfacing with the analog NTSC video from the camera. The EIA-422 and RJ-45 ports for the camera control and digital video connections must be terminated on the rear of the panel. The EIA-422, RJ-45, and BNC patch panel connection interfaces must be rack mountable units suitable for mounting in an EIA standard 19 inch cabinet.

### Testing

Test and demonstrate to the Engineer control capability and video viewing from the LPP. Demonstrate pan, tilt, zoom, preset, focus, and iris control functions. Demonstrate the capability to set and read the camera control ID, to create and modify the video titler, and to retrieve the camera information such as camera position and alarms. Demonstrate full-motion analog video from the BNC connection. Demonstrate digital video meets the digital video requirements using software viewer. Provide equipment and software package (Windows 2000 or later) without additional cost to the State, to test the MPEG 4 video, H.264 video, and to perform the camera control using the Ethernet at the cabinet site.

Prior to installation, you must verify video and camera control from the LARTMC on existing equipment before installing the new camera assembly.

After installation, you perform analog video testing and serial control testing at the LARTMC.

### EIA-232 TO EIA-422 CONVERTER

The port-powered two-channel EIA-232 to EIA-422 converter must convert EIA-232 TD and RD lines to balanced EIA-422 signals. The unit can be powered either from DTS or RTS of EIA-232 handshake lines. Only one of these lines must be present, and the unit will work regardless whether the lines are high or low. The unit can also be powered externally on the terminal blocks. Both the EIA-422 driver and receiver are always enabled.

#### Connections for the EIA-232 to EIA-422 converter:

The converter is configured to transmit in both directions between an EIA-232 and EIA-422 system. The EIA-232 side is pinned out to connect directly into the COM port on the computer/laptop or any other DTE device (Table 1). The EIA-422 side of the converter is pinned out as described in Table 2. When connecting to an EIA-422 system, the converter must be connected with proper polarity as shown in Table 2. When no data is being sent and the driver is enabled, the EIA-232 line is negative and the EIA-422 line TD(A) is negative with respect to TD(B).

Table 1 – EIA-232 Pin Out	
Signal	DB-9 Female Pin #
TD	3
RD	2
RTS	7
CTS	8
DTR	4
DSR	6
DCD	1
GND	5

Table 2 – Connection to an EIA-422	
Terminal block	EIA-422
TD(A)	RD(A)
TD(B)	RD(B)+
RD(A)	TD(A)-
RD(B)	TD(B)+
GND	GND

**Specification for the EIA-232 to EIA-422 converter:**

1. Communication: EIA-422
2. Data Rate: Up to 115.2 kbps max.
3. Power: Port-powered from handshake lines on the EIA-232 side
4. Dimensions: 3.5 x 1.3 x 0.7 inches
5. Temperature: From 0 to 159 °F

**FIBER OPTIC CONTROL MODEM**

Fiber optic control modem (FOCM) must operate asynchronously with a serial EIA-232 compatible interface with Tx data, Rx data, DCD, RTS, CTS, and signal ground interface lines.

The FOCM must have the following configuration:

1. The modem is intended for use in a polled multi-drop fiber optic daisy-chained system.
2. The modem must use Caltrans standard FSK modulation for 4800 or 9600 baud data rates.
3. There must be two fiber optic interfaces, primary and secondary. DCD must be asserted for a Rx data carrier on either fiber optic interface. Rx data from the primary interface will be placed on the Rx data line of the EIA-232 interface. The presence of DCD must inhibit the generation of CTS in response to RTS, otherwise the modem must generate RTS within 8 ms. When RTS is asserted, Tx data will be sent on the primary fiber optic interface. Duplicating TX data to the secondary fiber optic interface must be switch selectable. Rx data on the primary fiber optic interface must be retransmitted on the secondary fiber optic interface. Rx data on the secondary fiber optic interface must be retransmitted on the primary fiber optic interface.
4. The modem may have a switch selection to copy Rx data on the secondary fiber optic interface to the EIA-232 interface. The fiber optic transmitters must have a launch power no less than -8 dBm into standard singlemode fiber optic cables.
5. The modem must use ST connectors. The fiber optic operating wavelength must be 1310 nm. The EIA-232 interface must use a standard DB-25 connector.
6. The modem must have an optical power budget of 15 dB with an error rate less than  $1 \text{ in } 710^8$ .
7. The modem must have bridging audio port with the ability to connect to Caltrans Model 496 modems to bridge to multiple nearby controllers and receive polls for them and transmit their data for them.

**SINGLE FIBER VIDEO TRANSMITTER OR RECEIVER**

Video transmitters must be installed at controller cabinet locations as shown on the cabinet layouts on the plans.

Video transmitters must accept NTSC baseband video signals and convert them to optical signals suitable for launching into singlemode fiber.

Video transmitters must include mounting hardware necessary to mount in EIA standard 19-inch equipment racks in cabinets, mounted to allow easy access to connections and indicators. Transmitters may be mounted in video transmitter mainframes supplied and installed as shown on the plans and in accordance with these special provisions.

The video signal must modulate the optical source to produce a frequency modulated optical signal. Optical emitters must have a center wavelength in the range of 1310 to 1550 nm at 77 °F. Transmitters must interface to fiber with a ST style compatible connector. The video transmitter launch power must be defined as the power launched by the transmitter into at least 3 feet of the singlemode fiber optic cable, installed for CCTV camera locations. Video transmitter launch power must be at least 18 dB greater than the video receiver sensitivity. The optical modulation bandwidth required by the video transmitter for the specified video link performance must be 60 MHz, minimum.

Video transmitters must operate over a temperature range from -40 to 165 °F. Power must be supplied from existing 120 V ±15 percent, 60 Hz ±5 percent power receptacles inside cabinets reserved for communications equipment. Video transmitters must include power supplies, which may be external to video transmitter components. Power supplies must supply voltages required by video transmitters for operation, and have panel indicators visible from the front that shows DC power on.

Video interfaces to video transmitters must be nickel-plated, bulkhead female BNC-style connectors with gold plated contacts. Video transmitters must accept composite video signals at a level of 1.0 V peak to peak between sync tip and reference white, as measured on an oscilloscope. Transmitters must operate as specified when the peak-to-peak value of the signal varies from 0.71 to 1.4 V. Nominal input impedance must be 75  $\Omega$  and the return loss must be at least 30 dB in compliance with EIA RS 250 medium haul for an unbalanced connection.

Prior to installation, operation of equipment must be verified using the same type of fiber it is to be installed with. The fiber optic path for video links must have been tested and verified in accordance with these special provisions prior to the video transmitter installation.

Perform pre-installation testing to verify that video transmitters and video receivers are compatible, meet manufacturers specifications and the requirements of these special provisions.

Connect optical pigtails to optical connectors on video transmitters. Pigtails must be neatly trimmed together when routing them along the same path and support rails in equipment racks. No cables must be installed with a bend radius less than the manufacturer's minimum recommended bending radius.

You must input a video test signal into video transmitters and use variable optical attenuators to set optical power at video receivers to the video receiver sensitivity level. Optical signals must be connected to video receivers with a monitor connected to output. The Engineer will qualitatively assess monitor output. Signal-to-noise and signal-to-low frequency noise must be measured and recorded.

Attention is directed to "System Testing and Documentation," of these special provisions regarding video transmitter testing.

Provide operation and maintenance manuals for video transmitters conforming to the requirements in "System Testing and Documentation" of these special provisions.

### **10-3.23 VIDEO NODE**

The video node (location LB237) must also serve as a testing point for the fiber optic cables and for the video circuits<sup>5</sup>. The video node (location LB237) must consist of:

1. Installing:
  - 1.1. Fiber distribution unit (FDU), local patch panel (LPP), Camera control modems (CCM), fiber optic control modem (FOCM), Video receivers, Video Multiplexers, Model 334-TV video node controller cabinet, and connecting wires and cables.
  - 1.2. Mounting shelves or racks with power supply.
2. Terminating, connecting wires and cables, including, but not limited to, video composite, coaxial, jumpers and fiber optic cables, and incidentals, to make the installed equipment fully operational,
3. complete in place, as shown on the plans, and as directed by the Engineer.

New equipment must be current standard production units and must have been in production for a minimum of 6 months.

Your attention is directed to "Single Fiber Video Transmitter or Receiver" and "Local Patch Panel" under "Closed Circuit Television Camera Location", "Camera Control Modem", under "Data Node" , "Fiber Distribution Unit", "Communication Pull Boxes" and "Fiber Optic Cable" under "Communication System", and "Video Link Testing" and "Data Link Testing" under "System Testing and Documentation", in these special provisions.

#### **MODEL 334-TV VIDEO NODE CONTROLLER CABINET**

Model 334-TV video node controller cabinet must conform to the provisions in "Model 334-TV Controller Cabinets" of these special provisions.

#### **VIDEO MULTIPLEXER AND VIDEO DEMULTIPLEXER**

For digital video and data transmission, you must install 16-channel video multiplexers and video demultiplexers, also referred to as digital video multiplexer and demultiplexer links.

The 16-channel video multiplexer and demultiplexer must be compatible with existing Optelecom SpectraStream 128 Coarse Wavelength Division Multiplexing (CWDM) system Caltrans currently uses and operates.

The 16-channel video multiplexers and demultiplexers must be capable of transporting one channel of bi-directional data.

The digital video multiplexer/demultiplexer links between video node (Location LB237) and East LA hub building must have 16 video channels. The video multiplexers and demultiplexers must be used to transmit 16 analog NTSC video signals and a minimum on one full duplex EIA-232 data channel over a single fiber using reliable digital video multiplexing technologies.

The video multiplexers must interface directly with the digital video links from CCTV cameras as well as from fiber optic video receivers.

The 16-channel video multiplexers and demultiplexers must consist of the following components:

1. Minimum 16-slot rack mount chassis (one for transmit, one for receive)
2. Rack-mounted chassis power supplies (dual per chassis)
3. 5-channel Optical Channel CWDM Transmit (TX) cards with FC connectors
4. 5-channel Optical Channel CWDM Receive (RX) cards with FC connectors
5. 8-channel Digital Video Transmit (TX) card, CWDM, 1510 nm with full duplex EIA-232 transmission capability
6. 8-channel Digital Video Transmit (TX) card, CWDM, 1530 nm
7. 8-channel Digital Video Transmit (TX) card, CWDM, 1550 nm
8. Four 8-channel Digital Video Receive (RX) cards, CWDM

The CWDM Optical Channel CWDM Transmit (TX) cards must combine up to 5 different CWDM wavelengths for up to 32-channels of video and one channel of full duplex data on a single fiber. The Optical Channel CWDM Receive (RX) cards must separate up to 5 different CWDM wavelengths for up to 32-channels of video and one channel of full duplex data on a single fiber.

The 8-channel Digital Video TX card must multiplex 8 channels of video on one CWDM wavelength. Wavelengths supported must be 1510 nm, 1530 nm, 1550 nm and 1570 nm. The 8-channel Digital Video RX card must multiplex 8 channels of video on one CWDM wavelength. The Digital Video TX card and Digital Video RX card operating at 1510 nm wavelength must also carry the return data (demultiplexer to multiplexer) on the 1310 nm wavelength. An RJ-45 connector must be used for EIA-232 data interface

The system must be able to transmit 32-channels of video and one channel of EIA-232 data on one singlemode fiber optic strand over distances up to 50 miles or the distance of each link (whichever is greater) without the need for additional optical repeater hardware.

The supplied hardware must be field proven to meet or exceed RS-250C Medium Haul Transmission and have video cards supporting SNR >67dB.

The 8-channel digital video RX cards must have female BNC connectors, at the rear of the module to accept the input signal from the sources. These connectors must be designed to interface with 75  $\Omega$  coaxial cable. The fiber optic transmitter must use an FC style compatible connector and be compatible with the fiber optic cable Type FC connector mating connector on the fiber optic cable specified in these special provisions.

Test points must be provided on the multiplexer panels of the fiber optic transmitter to allow in-service measurement of relevant signals without causing any disturbances in the output of the fiber optic transmitter.

Indicators must be provided on the front panel of the video transmitter to allow operator verification of the correct performance of the fiber optic transmitter. The video transmitter must be capable of interfacing with and operating over fiber optic cable as specified elsewhere in these special provision.

The video multiplexers and demultiplexers must be easily expandable to support up to 64 or more channels of video transmission over the same chassis by adding more video and CWMD cards within the spare chassis slots in the existing 16 or 32-channel units.

The video multiplexer and demultiplexer equipment must mount in an EIA 19 inches equipment rack, either as separately mountable sub-units or as a card cage. The equipment must include all necessary hardware mounting and adapters. The 32-channel video multiplexer and the demultiplexer units, including power supplies, must each occupy no more than 7 vertical inches of rack space and must be no deeper than 12 inches.

Each system component described must be mounted on one or more PC boards. In addition, one PC board may support two or more functional components or the partial function of a component with the exception of the power supply, which must be mounted on a separate PC board slot or boards. All electronic components must be mounted on PC boards. The PC boards must be easily replaceable without requiring special tools.

All specifications for the video multiplexer and demultiplexer equipment must have an operating temperature range from -40 to +165 °F. The storage temperature range must be from -67 to +185 °F. The operating relative humidity range must be from 0 to 95 percent non-condensing.

The power supply for the video multiplexer and demultiplexer equipment must be powered from a 120 V(ac), 60 Hz power receptacle.

The system must be supplied with all the required software, user manuals, installation manuals, maintenance manuals and system troubleshooting guides sufficient to completely understand how to install, use and maintain the system.

## Installation

All components of the video multiplexer and demultiplexer must be installed at the locations and in the quantities as shown in the plans. Installation must include all required interface cable types as specified in these special provisions. All blank module slots in rack frame and power supply assemblies must be filled with a plate of construction and finish consistent with those of the modules. The filler plate must be field removable without a requirement for special tooling or any disassembly of the system. The system must provide the ability to remove and replace any module in the system without requiring that the power supply be turned off and without disturbing the operation of any other modules in the same rack frame and power supply assembly. All modules must be labeled on the front panel to identify the video signal or fiber passing through the module. The labeling technique must be such that all labels are neat and legible and must be removable and replaceable to allow for substitution of modules in the event of failure.

### 10-3.24 DATA NODE

The data node (location LB237) must serve as a testing point for the fiber optic cables and for the data circuits on Route 10. The data node at location LB237 must consist of:

1. Installing:
  - 1.1. Fiber distribution unit (FDU), camera control modem (CCM), fiber optic traffic modem (FOTM), fiber optic control modem (FOCM), D4 channel bank, DS1 optical modem, Model 334-TV data node controller cabinet, and connecting wires and cables.
  - 1.2. Mounting shelves or racks with power supply.
2. Terminating, connecting wires and cables, including, but not limited to, coaxial or fiber optic cables, jumpers, and incidentals, to make the installed or connected equipment fully operational,
3. Complete in place, as shown on the plans, and as directed by the Engineer.

New equipment must be current standard production units and must have been in production for a minimum of 6 months.

The Contractor's attention is directed to "Fiber Optic Traffic Modem" and "Fiber Distribution Unit", "Communication Pull Boxes" and "Fiber Optic Cable" under "Communication System", "Fiber Optic Control Modem" under "Closed Circuit Television Camera Location", and "Video Link Testing" and "Data Link Testing" under "System Testing and Documentation", in these special provisions.

### MODEL 334-TV DATA NODE CONTROLLER CABINET

Model 334-TV data node controller cabinet must conform to the provisions in "Model 334-TV Controller Cabinets" of these special provisions.

### DATA MULTIPLEXER

This equipment will be used to digitize the narrow bandwidth analog and quasi-analog signals and to time-division multiplex them into a 1.544 Mb/s composite data signal. The Data multiplexer must satisfy the following requirements:

#### Physical:

Operating temperature	32 to 122 °F
Relative Humidity	95 percent non-condensing

#### Dimensions:

Height	Less than 18 inches
Width	19 inches
Depth	Less than

**Electrical:**

Line Rate	1.544 Mbps $\pm$ 200 bps (stratum 4)
Line Code	B8ZS
Sampling Format	D4
Framing Format	ESF
Line Impedance	100 $\Omega$ $\pm$ $\Omega$
Power Input	120 V(ac) $\pm$ 12 V at 60 $\pm$ 3 Hz, 3 A minimum

The Data multiplexer must be fully configured to house up to 24 DS-0 channel cards at 64 kbps framing with 8 kbps overhead and must multiplex up to 24 voice or data channels for transmission over a DS-1 data channel. The channel bank must be type-accepted in accordance with the FCC Regulations, Part 68. The common card units must provide the transmit, receive, power distribution, timing, and alarm functions.

The Data multiplexer must be installed in the standard equipment EIA 19 inches racks as shown on the plans. The D4 channel bank must be fully connected to the existing DSX-1 jackfield housed in the Los Angeles Regional Traffic Management Center (LARTMC) building. The D4 must be cross connected to the audio jackfield as shown on the plans. The Data multiplexer must be tested end-to-end from the existing DSX-1 jackfield to the terminal equipment housed in Los Angeles Regional Traffic Management Center (LARTMC) building. Each slot within the Data multiplexer must be individually tested by moving cards from slot-to-slot.

The power supply must convert 120 to 48 V(dc) with a 2 A output.

The Data multiplexer must include the following channel cards of the types and quantities as shown on the plans.

- 1- AC/DC Power Supply
- 1- Line Interface Unit card
- 1- DC/DC card
- 4WTO cards

You must supply the quantities of each card identified on the plans. The Data multiplexer must be installed in accordance with the manufacturer's installation instructions.

You must adjust the levels of the Data multiplexer to achieve a zero transmission level point (TLP) at the SGV hub communication building. You must measure end-to-end performance of the analog and digital parameters under full operation.

The D4 channel cards must be designed to physically plug into any available channel card slot of the D4 multiplex unit with electrical power on. Each D4 channel card must use no more than 5 W maximum power supplied by the D4 multiplex unit. The A/D and D/A channel conversion frequency for channel cards must be 8000  $\pm$ 2 Hz.

D4 channel cards must meet required operating specifications over a temperature range from 32 to 122 °F and with maximum relative humidity of 95 percent, non-condensing.

Channel cards must satisfy the following requirements:

Return Loss:	(per AT&T Pub. 43801)
ERL:	28 dB
SRL:	20 dB
Idle Noise, Single Ended:	19 dBBrnC0
Idle Noise, End-to-End:	22 dBBrnC0
Crosstalk Coupling Loss:	65 dB, 200 to 3400 Hz
C-message weighted.	

#### 4-Wire Transmit Only - (4WTO)

The 4-wire transmit only channel card must meet the following requirements:

Channel Coding Resolution:	8 voice bits per channel
Normal Transmission Level Point (TLP):	transmit: -17.5 to +8.0 dBm receive: -16.9 to +8.5 dBm
TLP range:	-24 to +8 dBm transmit and receive
Drop Impedance:	600 $\Omega$

Frequency Response (1004 Hz reference):		
Frequency (Hz)	Transmit Level (dB)	Receive Level (dB)
60	< -14 Max.	< -14 Max
200	-2.0 to +0.15	-1.0 to +0.15
300-3000	$\pm 0.15$	$\pm 0.15$
3200	-0.75 to +0.15	-0.75 to +0.15
3400	-1.5 to +0.15	-1.5 to +0.15
4000	< -14 Max.	< -14 Max.

#### 2 Wire Foreign Exchange - (2WFXS)

The 2-wire foreign exchange channel card must meet the following requirements:

Channel Coding Resolution:	8 voice bits per channel, 5 of 6 frames, 7 voice bits per channel, 1 of 6 frames, 1 signaling bit per channel, 1 of 6 frames
Normal Transmission Level Point (TLP):	transmit: -17.5 to +2.8 dBm receive: -21.5 to +7 dBm
TLP range:	-24 to +8 dBm transmit and receive
Drop Impedance:	600 or 900 $\Omega$ and 2.15 $\mu$ F

Frequency Response (1004 Hz reference):		
Frequency (Hz)	Transmit Level (dB)	Receive Level (dB)
60	-14 Max.	-14 Max
200	-3.0 to +0	-2.0 to +0
300-3000	-0.5 to +0.25	-0.5 to +0.25
3200	-0.75 to +0.25	-0.75 to +0.25
3400	-1.5 to +0.25	-1.5 to +0.25

#### Signaling:

Dial pulse distortion	-5 to +3 percent, at 12 PPS, 60 percent break
Pulse rate range	8 to 14 PPS.
Loop length limit	< 2000 $\Omega$ without buildout resistors < 1000 $\Omega$ with buildout resistors
Ring trip time	= 250 ms
Ring ground detect range	=1500 $\Omega$ without buildout resistors =1000 $\Omega$ with buildout resistors
Interrupted ringing (PLAR)	2 seconds on and 4 seconds off

**General Specifications:**

Operating Temperature Range	32 to +122 °F
Dimensions Width	4.7" Height, 9.4" Depth, 1"Width
Mass	75 pounds
Mounting	Telco systems DDI-24 mounting assembly
Electrical Connection	44-pin card edge connector

**DS-1 OPTICAL MODEM**

DS-1 optical modems convert electrical signals of the Time Division Multiplexer's (TDM) aggregate interface and the optical signals used on the singlemode optical fiber facility. Two DS-1 optical modems and the fibers connecting them will form the T-1 transmission facility.

The electrical DS-1 interface of optical modems must comply with the ANSI T1.102-1987 standard. Physical interfaces must be a 15-pin D-type connector or a 4-position terminal strip with provision for grounding cable shields. Optical connectors must be the ST type. DS-1 optical modems must be transparent to zero-code suppression used by terminal equipment. If necessary, the output power of modem must be externally attenuated to be compatible with the optical loss of the fiber being used.

Optical interface must be designed for singlemode operation using an optical wavelength between 1310 and 1550 nm. Optical launch power of transmitters must be at least 20 dB greater than the sensitivity of receivers.

At no time must received optical power exceed the receiver's saturation level. Fixed optical attenuators with a return loss of greater than 15 dB must be provided. A bit error rate of less than or equal to 1 in  $10^{-9}$  must be certified over the specified operating ranges.

Optical modems must be installed as stand-alone units on shelves for field locations. DS-1 cables must be connectorized as appropriate. DS-1 modems must be available in stand-alone and rack-mount versions. Rack-mount card cages must be capable of housing a minimum of 7 modems in no more than 21 inches of vertical rack space. Hardware for mounting both versions of modems in standard 19-inch racks must be provided. DS-1 optical modems must operate from standard 60 Hz, 120 V(ac) power and operate as specified over a temperature range from -40 to 165 °F.

Optical receive power at modems must be measured and recorded before connection of receive optical pigtails. Optical fibers must be attached as required.

Fibers must be tested as follows:

1. Optical modems must be functionally tested by looping back optical transmit connectors to optical receive connectors using variable optical attenuators with measured optical loss of 10 dB at 1300 nm. DS-1 test sets must be connected to modems and set for ESF framing, B8ZS coding, internal timing, and a QRS pattern. Tests set must be set for the standard DSX-1 output level and terminated input. A 15-minute test after burn-in must be error free.
2. After performing the 15 minute bit error rate (BER) test, at least 2 modems must be tested for receiver dynamic range. Optical attenuation must be increased to the point at which data test begins to register bit errors. Optical receive power into modems must be measured and recorded. Optical attenuation must be decreased until the data test again registers errors. At no time must optical power into receivers exceed the manufacturer's specified saturation level. Optical received levels must again be measured and recorded. Minimum and maximum received levels define the modem receiver's dynamic range.

One pair of modems must be interconnected using optical patchcords and attenuators with a loss of 10 dB in each direction. DS-1 interfaces must be looped back on one modem and a DS-1 test set connected to the DS-1 interface of the other modem. A bit error rate of less than 1 in  $10^{-10}$  must be demonstrated.

Appendix C must be filled out in the presence of the Engineer.

**APPENDIX C**

**Optical Modem Test**

**Worksheet**

Contract No. \_\_\_\_\_ Contractor: \_\_\_\_\_

Operator: \_\_\_\_\_ Date: \_\_\_\_\_

Location: \_\_\_\_\_

DS-1 Optical Modem, Modem No. :		
Optical Receiver Power (max) into modem (10 <sup>9</sup> BER)	_____ dB	3A
Optical Receiver Level (minimum) into modem	_____ dB	3B
Receiver Dynamic Range (3A-3B):	_____ dB	3C

DS-1 Optical Modem, Modem No. :		
Optical Receiver Power (max) into modem (10 <sup>9</sup> BER)	_____ dB	4A
Optical Receiver Level (minimum) into modem	_____ dB	4B
Receiver Dynamic Range (4A-4B):	_____ dB	4C

DS-1 Optical Modem, Modem No. :		
Optical Receiver Power (max) into modem (10 <sup>9</sup> BER)	_____ dB	5A
Optical Receiver Level (minimum) into modem	_____ dB	5B
Receiver Dynamic Range (5A-5B):	_____ dB	5C

DS-1 Optical Modem, Modem No. :		
Optical Receiver Power (max) into modem (10 <sup>9</sup> BER)	_____ dB	6A
Optical Receiver Level (minimum) into modem	_____ dB	6B
Receiver Dynamic Range (6A-6B):	_____ dB	6C

**CAMERA CONTROL MODEM**

The camera control modem must meet the following specifications:

1. Operate asynchronously with a serial EIA-232 compatible interface with Tx data, Rx data, DCD, RTS, CTS, and signal ground interface lines.
2. Operate as a standard V.32 compliant bi-directional 9600 baud modem or as a gated carrier multi-drop modem.
3. Configured to be used in a polled multi-drop or point-to-point configuration over public telephone network or similar system. The standard signaling rate must be 9600 baud with other rates optional.
4. Respond to RTS within 3 ms and assert CTS. Transmission must continue while RTS is asserted, unless anti-streaming is enabled. If anti streaming is enabled the modem must at timeout de-assert CTS, stop transmitting and not transmit again until RTS has been de-asserted and asserted again.
5. Use a shortened training pattern of less than 100 ms at the beginning of a transmission.
6. Use the same modulation techniques as standard 9600 baud modems.
7. Be compliant with Part 68 of the FCC regulations.
8. Interoperate with the existing communications system.

### **10-3.25 SYSTEM TESTING AND DOCUMENTATION**

System testing and documentation must cover pre-installation testing, sub-system testing, fiber optic cable testing, video link testing, data link testing, acceptance testing, physical inspection, functional testing, performance testing, final acceptance and system documentation required to validate the operational performance of communications systems as described elsewhere in these special provisions.

#### **TEST PLAN**

You must submit 5 copies of an installation and test plan that details methods of installation, material, equipment, and cable testing, and a working day schedule to the Engineer within 14 working days. The Engineer will review the test plan and approve or disapprove it within 10 working days. If the Engineer rejects the test plan, submit a revised test plan within 20 working days for review and approval by the Engineer. No testing must be performed until the Engineer has approved your test plan. Tests must demonstrate that design and production of material and equipment meet the requirements of these special provisions. Test results, including results of failed tests or re-tests, must be submitted to the Engineer and a copy placed with the equipment at the site. You must supply test site equipment.

You must notify the Engineer of intent to proceed with functional and sub-system testing 48 hours prior to commencement of tests. Full environmental conditions must be recorded as part of the functional tests for field equipment. Sub-system testing and inspections must include visual inspection for damage in correct installation, adjustments and alignment, and measurement of parameters and operating conditions.

#### **Factory Testing**

Documentation for testing conducted at the manufacturer's premises must be submitted to the Engineer when the equipment is delivered to the site.

#### **Sub-system Testing**

Sub-system testing must encompass testing of material, equipment and cables after installation, but prior to acceptance tests. Tests must be in accordance with the performance testing for individual items.

Materials, equipment and cables must be tested after installation at the site. Sub-system testing and inspections must include visual inspection for damaged or incorrect installation, adjustments and alignment, and measurement of parameters and operating conditions. Notify the Engineer of intent to proceed with sub-system testing 48 hours prior to commencement of individual tests.

Installation documentation and test results must be provided for materials, equipment and cables prior to commencement of acceptance tests. Installation documentation must include the following as appropriate:

1. Model, part number and serial number for material and equipment.
2. Test equipment model number, serial number, settings, and date of last calibration.
3. Strap and switch settings.
4. Record of adjustments and levels.
5. Alignment measurements.
6. Identification of interconnections.

#### **Fiber Optic Cable Testing**

Attention is directed to "Fiber Optic Testing" of these special provisions.

#### **Video Link Testing**

Video link testing must be conducted after you submit a test plan and receives approval from the Engineer. A video link must be established from CCTV camera locations and Video Node (Location LB237) to East Los Angeles (ELA) Hub, then to Los Angeles Regional Transportation Management Center (LARTMC) for testing and verification. Measurements must be made from the baseband-in to baseband-out connections.

Video links in communications systems must be tested with a video test signal at the single fiber optic video transmitter input. You must perform level adjustments and alignments required on video links. If a video link fails to meet performance requirements, you must restore failed links to the required performance.

Video links in communications systems must be tested for qualitative performance with associated cameras turned on and connected to BNC connectors of video transmitters. Measure, record, and tabulate single fiber optic video receivers dynamic range at the optical connector of the new single fiber optic video receivers in the Video Node (Location LB237) and at the single fiber optic video transmitters at the CCTV camera locations under test using a 90 percent APL (average picture level) flat field input to the single fiber optic video transmitters. The output video signal must be connected to a video display monitor. The observed picture on the video display monitor must be assessed for qualitative performance. Qualitative comments must be recorded for individual cameras. The Engineer will approve the video test set. Measure, record and demonstrate that the performance meets or exceed the specified EIA RS-250 requirements listed below:

1. Differential gains.
2. Differential phases.
3. Chrominance to luminance delays inequality.
4. Amplitude vs. frequency characteristics.
5. Frequency response characteristic.
6. Signal to noise ratio.
7. Signal to low frequency noise.
8. Signal to periodic noise.
9. Output signal levels.

#### **Data link testing**

Data link testing for the alignment and testing of data systems must be conducted after you submit a test plan and receive approval from the Engineer. The activities must include verification of data circuits in the low speed data links, high speed data ring network and in the integrated data system. Adjust levels required for the data system to operate.

Data link tests must be conducted between East Los Angeles (ELA) Hub, LARTMC and the communication system equipment in the controller cabinets, including CCTV cameras and Model 170 controllers.

Records of tests must be delivered to the Engineer. Circuits must be fully tested to the channel card using a transmission impairment measuring set (TIMS). Bit error rate (BER) tests must be conducted using State-furnished Model 400 modems (or equivalent) at 1200 bps from LARTMC to the circuit terminus. BERTS must be used in a 3-hour test for each circuit.

The bit error rate in both directions must be less than  $1 \times 10^{-6}$  at 9600 bps for all circuits.

#### **Data link performance**

Data link performance tests must consist of functional tests conducted between the existing D4 channel bank multiplex in the existing East Los Angeles (ELA) Hub building, and from the new Data Node (Location LB237) to each field cabinet as shown on the plans. The audio channel must be verified in both directions using telephone instruments. The signaling system must be verified in both directions. In addition to circuits using 4 WTO channel cards for modems, bit error rate (BER) tests must be conducted using appropriate State-furnished Model 400, 1200 BPS modem or ITU compatible high speed modem, and a bit error rate test set (BERTS) must be used to verify error free transmission for 5 minutes at the bit rate to be employed in the system.

Records of tests must be delivered to the Engineer. Circuits must be tested to the channel card manufacturer's specifications. End-to-end bit error rate tests (BERTS) must be conducted using the type modem to be employed on the link at the bit rate to be employed. The BERTS must be with the modem at the equipment sites configured in a loop back and with the test setup at the node. The BERTS must be a minimum of 3 hours for each circuit, including required bridges.

#### **Acceptance Testing**

Acceptance testing must be conducted in accordance with the approved test plan. Acceptance testing must include acceptance tests and subsequent retests, and documentation of test results.

Test communications systems, according to the approved acceptance test plan, must provide test equipment, labor and ancillary items required to perform testing. Test equipment must be certified to be calibrated to manufacturer's specifications. The model, part numbers, and date of last calibration of test equipment must be included with test results.

Acceptance testing must not commence until materials required by these special provisions and plans are delivered, installed, and aligned and the Engineer has approved production test and site test documentation and results.

Acceptance test results must be documented and documentation provided to the Engineer as a condition of acceptance.

#### **Physical Inspection**

You must provide documentation to prove delivery of material, equipment, cable and documentation. If material or documentation is pending or has been replaced under pre-acceptance warranty, physical inspection and documentation must be provided. Physical inspection must consist of inspecting installed equipment to ensure quality workmanship.

### **Functional Tests**

Functional tests must be performed in accordance with an approved test plan.

Functional tests must include testing of camera images and verification of camera controls from camera control receivers. Connectivity of data channels must be demonstrated. Document functional test results. If an aspect of functional tests is determined by the Engineer to have failed, you must cease acceptance testing, determine the cause of the failure, and repair materials to the satisfaction of the Engineer. Acceptance testing must, at the discretion of the Engineer, be repeated beginning from the start of functional tests.

### **Performance Tests**

Conduct operational performance tests on the following:

1. Video links from CCTV camera locations to the East Los Angeles (ELA) Hub and LARTMC.
2. Data circuits operational from the CCTV camera locations, changeable message signs, ramp metering systems and, traffic monitoring stations to the East Los Angeles (ELA) Hub and LARTMC.

Video tests must satisfy the end-to-end performance requirements under normal operating conditions. Video tests must be measured with camera video output transmitting a video signal at the input of video display monitors. You must test the video sub-system and record the results. Test must be performed according to EIA-250, "Electrical Performance for Television Transmission" with minimum video signal to noise ratio as follow:

Video Signal Test	Minimum Requirement
Video Signal to Noise Ratio	47 dB
Video Signal to Low Frequency Noise Ratio	39 dB
Video Signal to Periodic Noise Ratio	52 dB

Data tests must be performed on operational and data circuits using appropriate test equipment for the measurement of the following parameters:

Run end-to-end bit error rate tests from the data nodes and cable node to individual remote drop of individual data circuit. A data test set must be used at cable nodes and remote modems to insert an asynchronous pseudo-random pattern using 8 data bits, 1 start bit, 1 stop bit and even parity. The data test set at remote modems must hold RTS high for the duration of the data test. The data rate of the test sets must be set to rate as employed in the system.

A 15-minute test on individual drop of multipoint circuits must be error free in both directions. One drop of individual circuit as chosen by the Engineer must be tested for 72 hours.

Distortion must be tested between cable nodes and the field modem for data circuits. Signals must not have a gross span-stop distortion greater than 20 percent at a data interface measured as per EIA-404-A.

If a circuit or element fails to satisfy the specified performance requirements, determine the cause and correct the failure to the satisfaction of the Engineer. Full performance tests must be repeated under operating conditions as determined by the Engineer.

### **SYSTEM DOCUMENTATION**

Submit draft documentation 8 week prior to the start of installation. The Engineer will review and approve or reject the draft documentation within 2 weeks of receipt. Draft documentation must show the general approach in preparing final manuals.

Arrange for re-submission within 2 weeks if the documents are rejected.

Final documentation must be submitted no later than 4 weeks after completion of the acceptance tests and must incorporate comments made during approval stages. You are responsible for delay caused by non-compliance to requirements. Ten copies of final documents must be delivered. The copies must be 8.5 inch x 11 inch paper and bound in 3-ring hard-cover binders with dividers.

System documentation must be arranged in an operation and maintenance (O & M) manual format providing information necessary to operate, maintain and repair equipment and cables to the lowest module or component level.

Operations and maintenance manuals must as a minimum consist of the following sub-sections:

1. Master Items Index: This must be the first section of the O & M manual. The section must describe the purpose of individual manual and brief description to the directory of the manual. It must reference equipment manuals as required for additional and support material. Accurate Block Diagrams must be included.
2. System Description and Technical Data: This section must contain an overall description of the system and associated equipment and cables with illustrative block diagrams. This section must identify equipment and cables in the system stating the exact module and option number that are employed in the system. Technical data specification and settings for every type of equipment or cable must be provided. Modifications to equipment must be clearly described.
3. Theory of Operation: The manual must contain a functional description of elements of the system, explaining how an individual function is achieved separately and how elements work together to form the complete system.
5. Operations: The manual must describe how to operate the system and a particular type of equipment and software. Equipment layout, layout of controls, displays, software operating procedures and other information required to correctly operate the system and each functional unit must be provided. Procedures must be provided for initial tune-up of the system and adjustment and checkout required to ensure that the system is functioning within the performance requirements. Warning of special and turn on procedures must be included. The functions and setting of parameters must be explained.
8. Parts List: The manual must include a list of replaceable parts with exact parts description and number and a directory of recommended suppliers with correspondence address, telephone and fax numbers.

Provide system schematic drawings to identify the type of equipment at individual location. Drawings must show how systems are interconnected. A list of cabling and wiring must be provided to identify the interconnection and labeling of equipment in the field.

### **FINAL ACCEPTANCE**

Final acceptance of systems will not occur until the following conditions have been met:

1. Physical, functional and full performance acceptance tests have been completed and the Engineer approves the results.
2. Documentation has been completed and submitted to the Engineer.
3. Connections that were changed to perform acceptance tests are restored and tested.

### **10-3.26 REMOVING, REINSTALLING OR SALVAGING ELECTRICAL EQUIPMENT**

Salvaged electrical materials shall be hauled to the Department of Transportation, Terminal Island Maintenance Station, at 400 North Seaside Avenue, Terminal Island, San Pedro, CA 90731 and stockpiled.

The Contractor shall provide the equipment, as necessary, to safely unload and stockpile the material. A minimum notice of 5 business days shall be given prior to delivery.

### **10-3.27 DISPOSING OF ELECTRICAL EQUIPMENT**

Ballasts and transformers that contain polychlorinated biphenyl (PCB) are designated as extremely hazardous wastes and fluorescent tubing and mercury lamps are designated as hazardous wastes under Title 22, Division 4.5, Chapter 11, Article 4.1 and Article 5, of the California Code of Regulations.

The State assumes generator responsibility for these wastes. The Engineer will prepare the Hazardous Waste Manifest for Shipment. Ballasts shall be packaged and transported to a hazardous waste disposal facility. The Contractor shall package and transport fluorescent lights to an appropriately permitted facility.

### **PAYMENT**

Full compensation for hauling, stockpiling, and disposing of transformers, fluorescent tubing and mercury lamps and non-leaking fluorescent light ballasts shall be considered as included in the contract price paid for the various items of work and no additional compensation will be allowed therefor.

### **10-3.28 PAYMENT**

Full compensation for hauling and stockpiling electrical materials shall be considered as included in the contract price paid for the item requiring the material to be salvaged and no additional compensation will be allowed therefor.

If any of the fabrication sites for the materials listed are located more than 300 air line miles from both Sacramento and Los Angeles, additional shop inspection expenses will be sustained by the State. Whereas it is and will be impractical and difficult to determine the actual increase in these expenses, it is agreed that payment to the Contractor for furnishing these listed materials from each fabrication site located more than 300 air line miles from both Sacramento and Los Angeles will be reduced \$2,000:

1. Service equipment enclosures
2. Closed circuit television cabinets furnished by the Contractor

The contract lump sum price paid for modify automatic vehicle classification station includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals; and for doing all the work involved in modify automatic vehicle classification station, complete in place, including relocating Model 334 controller cabinet, installing automatic vehicle classification unit, conductors and screened transmission cables, loop detector lead-in cables, conduits, pull boxes, inductive loop detectors, epoxy grout and piezoelectric axle sensors, and acceptance testing, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for lighting (bikeway) includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in lighting (bikeway), complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for communication system includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in communication system, including installing communication conduits, fiber optic cables, pull boxes, splice vaults, fiber optic traffic modems, fiber distribution units, including ancillary or incidental items required, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum prices paid for closed circuit television camera at various locations includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in closed circuit television camera at various locations, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for data node (Location LB237) includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in data node, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for video node (Location LB237) includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in video node, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for changeable message sign at various locations includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in changeable message sign at various locations, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for system testing and documentation includes full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in system testing and documentation, as specified in the Standard Specification, and these special provisions, and as directed by the Engineer

## **SECTION 11. (BLANK)**

## **SECTION 12. (BLANK)**

## **SECTION 13 RAILROAD RELATIONS AND INSURANCE REQUIREMENTS**

### **13-1.01 GENERAL**

The term "Railroad" shall mean "Los Angeles Junction Railway Company", "BNSF Railway Company" (BNSF), "Burlington Northern Santa Fe Corporation" and the subsidiaries, successors, assigns, and affiliates of each.

It is expected that the Railroad will cooperate with the Contractor to the end that the work may be handled in an efficient manner. However, except for the additional compensation provided for hereinafter for delays in completion of specific unit of work to be performed by the Railroad, and except as provided in Public Contracts Code Section 7102, the Contractor shall have no claim for damages, extension of time, or extra compensation in the event his work is held up by railroad train operations or other work performed by the Railroad.

The Contractor must understand the Contractor's right to enter the Railroad's property is subject to the absolute right of the Railroad to cause the Contractor's work on the Railroad's property to cease if, in the opinion of the Railroad, the Contractor's activities create a hazard to the Railroad's property, employees, and operations.

The Contractor acknowledges there is no State Contractor's Right of Entry Agreement and the Contractor has no authority in the Railroad Right of Way without an executed State Right of Entry Agreement that has been executed by the Railroad and the State.

### 13-1.02 RAILROAD REQUIREMENTS

The Contractor shall provide to Melvin Thomas, Railroad's Senior Manager, Industry and Public Projects, 740 East Carnegie Drive, San Bernardino, CA, Bloomington, California 92408, and the Engineer, in writing, the advance notice requirements set forth in the Construction & Maintenance Agreement before performing any work on, or adjacent to the property or tracks of the Railroad.

Prior to performing any activities on BNSF property or near BNSF tracks with its own personnel, STATE shall: (i) comply with all of BNSF's applicable safety rules and regulations; (ii) require any STATE employee working on BNSF property or near BNSF tracks to complete the safety training program at BNSF's Internet Website "contractororientation.com"; (iii) notify BNSF when, pursuant to the requirements of Exhibit C, a flagger is required to be present; and (iv) pay BNSF for the cost of BNSF's Risk Management Department's Railroad Protective Liability insurance.

STATE must require its contractor(s) to notify BNSF's Roadmaster at least thirty (30) calendar days prior to requesting a BNSF flagman.

The Contractor shall construct behind the headwall a retaining wall, ranging from 6.5 feet to 10 feet, to accommodate the proposed widening of the freeway. All construction will take place on existing State right of way, and no real property acquisition is required from the Railroad. Existing vertical clearances will not be altered.

The Contractor will install a permanent 3 foot concrete barrier topped with 6 foot chain link fencing (closest to the shoulder), and permanent cable railing fencing (beyond the concrete/chain link fencing) on the widened (southbound) side of Cheli Depot Overhead crossing the Railroad right of way. Both of these fences will be designed to protect the Railroad facility and personnel below from falling objects.

The limits of the fence with barrier rail shall extend to the limits of the Railroad right of way or a minimum of 25 feet beyond the centerline of the outermost existing track, future track or Access Road, whichever is greater. All parallel Overhead Structures that have a gap of 2 feet or more shall be protected with fencing. Structures with a gap of 2 feet or less shall either have the gap covered or be fenced on both sides.

The minimum combined height of a barrier rail with curved fence shall be 8 feet or with a straight fence shall be 9 feet. All other details of the barrier rail with fence shall be in accordance to the plans.

The Contractor shall cooperate with the Railroad where work is over or under the tracks, or within the limits of the Railroad property to expedite the work and avoid interference with the operation of railroad equipment.

The Contractor shall comply with the rules and regulations of the Railroad or the instructions of its representatives in relation to protecting the tracks and property of the Railroad and the traffic moving on such tracks, as well as the wires, signals and other property of the Railroad, its tenants or licensees, at and in the vicinity of the work during the period of construction. The responsibility of the Contractor for safe conduct and adequate policing and supervision of its work at the job site shall not be lessened or otherwise affected by the presence at the work site of the Railroad representatives, or by the Contractor's compliance with any requests or recommendations made by the Railroad representatives.

The Contractor shall perform work so as not to endanger or interfere with the safe operation of the tracks and property of the Railroad and traffic moving on such tracks, as well as wires, signals and other property of the Railroad, its tenants or licensees, at or in the vicinity of the work.

The Contractor shall take protective measures to keep the Railroad facilities, including track ballast, free of sand or debris resulting from his operations. Damage to the Railroad facilities resulting from the Contractor's operations will be repaired or replaced by the Railroad and the cost of such repairs or replacement shall be deducted from the Contractor's progress and final pay estimates.

The Contractor shall contact the Railroad's "Call Before You Dig" at least forty-eight (48) hours prior to commencing work, at 1-800-336-9193 during normal business hours (7:00 a.m. to 9:00 p.m. Central Time, Monday through Friday, except holidays – also a 24-hour, 7-day number for emergency calls) to determine location of fiber optics. If a telecommunications system is buried anywhere on or near the Railroad property, the Contractor will coordinate with the Railroad and the Telecommunication Company(ies) to arrange for relocation or other protection of the system prior to beginning any work on or near Railroad property.

The Contractor shall not pile or store any materials nor park any equipment closer than 25'-0" to the centerline of the nearest track, unless directed by the Railroad's representative.

The Contractor shall also abide by the following temporary clearances during the course of construction:

3.66 meter (12'-0") horizontally from centerline of track

6.40 meter (21'-0") vertically above top of rail

The temporary vertical construction clearance above provided will not be permitted until authorized by the Public Utilities Commission. It is anticipated that authorization will be received not later than fifteen (15) days after the approval of the contract. In the event authorization is not received by the time specified, and, if in the opinion of the Engineer, the Contractor's operations are delayed or interfered with by reason of authorization not being received by the said time, the State will compensate the Contractor for such delay to the extent provided in Section 8-1.09, "Right of Way Delays," of the Standard Specifications and not otherwise.

Walkways with railing shall be constructed by the Contractor over open excavation areas when in close proximity of tracks, and railings shall not be closer than 2.60-meter (8'-6") horizontally from centerline of the nearest track, if tangent, or 2.90-meter (9'-6") if curved.

Infringement on the above temporary construction clearances by the Contractor's operations shall be submitted to the Railroad by the Engineer, and shall not be undertaken until approved by the Railroad, and until the Engineer has obtained any necessary authorization from any governmental body or bodies having jurisdiction thereover. No extension of time or extra compensation will be allowed in the event the Contractor's work is delayed pending Railroad approval and governmental authorization.

When the temporary vertical clearance is less than 6.86-meter (22'-6") above top of rail, the Railroad shall have the option of installing tell-tales or other protective devices the Railroad deems necessary for protection of the Railroad trainmen or rail traffic.

Four (4) sets of plans, in 279mm x 432mm (11" x 17") format, and two (2) sets of calculations showing details of construction affecting the Railroad's tracks and property not included in the contract plans, including but not limited to shoring and falsework, shall be submitted to the Engineer for review prior to submittal to the Railroad for final approval. Falsework shall comply with the Railroad guidelines. Demolition of existing structures shall comply with the Railroad guidelines. Shoring shall be designed in accordance with the Railroad's shoring requirement of Drawing No. 106613 and guidelines for shoring and falsework, latest edition, issued by the Railroad's Office of Chief Engineer. Shoring and falsework plans and calculations shall be prepared and signed by a professional engineer registered in California. This work shall not be undertaken until such time as the Railroad has given such approval, review by the Railroad may take up to six (6) weeks after receipt of necessary information.

The Contractor shall notify the Engineer in writing, at least twenty-five (25) calendar days but not more than forty (40) days in advance of the starting date of installing temporary work with less than permanent clearance at each structure site. The Contractor shall not be permitted to proceed with work across railroad tracks until this requirement has been met. No extension of time or extra compensation will be allowed if the Contractor's work is delayed due to failure to comply with the requirements in this paragraph.

Blasting will be permitted only when approved by the Railroad.

The Contractor shall, upon completion of the work covered by this Contract to be performed by the Contractor upon the premises or over or beneath the tracks of the Railroad, promptly remove from the premises of the Railroad, the Contractor's tools, implements and other materials, whether brought upon said premises and cause said premises to be left in a clean and presentable condition.

Under track pipeline installations shall be constructed in accordance with the Railroad's current standards which may be obtained from the Railroad. The general guidelines are as follows:

- Edges of jacking or boring pit excavations shall be a minimum of 6.10-meter (20 feet) from the centerline of the nearest track.
- If the pipe to be installed under the track is 100mm (4 inches) in diameter or less, the top of the pipe shall be at least 42 inches below base of rail.
- If the pipe diameter is greater than 100mm (4 inches) in diameter, it shall be encased and the top of the steel pipe casing shall be at least 1.60-meter (66 inches) below base of rail.
- Installation of pipe or conduit under the Railroad's tracks shall be done by dry bore and jack method.
- Hydraulic jacking or boring will not be permitted.

Safety of personnel, property, rail operations and the public is of paramount importance. As reinforcement and in furtherance of overall safety measures to be observed by the Contractor (and not by way of limitation), the following special safety rules shall be followed:

- (a) The Contractor shall keep the job site free from safety and health hazards and ensure that its employees are competent and adequately trained in all safety and health aspects of the job. The Contractor shall have proper first aid supplies available on the job site so that prompt first aid services can be provided to any person that may be injured on the job site. The Contractor shall promptly notify the Railroad of any U.S. Occupational Safety and Health Administration reportable injuries occurring to any person that may arise during the work performed on the job site. The Contractor shall have a non-delegable duty to control its employees while they are on the job site or any other property of the Railroad to be certain they do not use, be under the influence of, or have in their possession any alcoholic beverage, drug, narcotic or other substance that may inhibit the safe performance of work by the employee.

- (b) The employees of the Contractor shall be suitably dressed to perform their duties safely and in a manner that will not interfere with their vision, hearing or free use of their hands or feet. Only waist length shirts with sleeves and trousers that cover the entire leg are to be worn. If flare-legged trousers are worn, the trouser bottoms must be tied to prevent catching. The employees should wear sturdy and protective work boots and at least the following protective equipment:
  - (1) Protective head gear that meets American National Standard-Z89.1-latest revision. It is suggested that all hardhats be affixed with the Contractor's or the subcontractor's company logo or name.
  - (2) Eye protection that meets American National Standard for occupational and educational eye and face protection, Z87.1-latest revision. Additional eye protection must be provided to meet specific job situations such as welding, grinding, burning, etc.; and
  - (3) Hearing protection which affords enough attenuation to give protection from noise levels that will be occurring on the job site.
- (c) All heavy equipment provided or leased by the Contractor shall be equipped with audible back-up warning devices. If in the opinion of the Railroad Representative any of the Contractor's or the subcontractor's equipment is unsafe for use on the Railroad's right-of-way, the Contractor, at the request of the Railroad representative, shall remove such equipment from the Railroad's right-of-way.

### **13-1.03 PROTECTION OF RAILROAD FACILITIES**

Upon the advance notification provided to the Railroad as set forth in the Service Contract, the Railroad representatives, conductors, flagmen or watchmen will be provided by the Railroad to protect its facilities, property and movements of its trains or engines. Notice shall be made to the Railroad's Manager of Track Maintenance at Tel No. 909-386-4472 and Fax No. 909-386-4479. At the time of notification, the Contractor shall provide the Railroad with a schedule of dates that flagging services will be needed, as well as times, if outside normal working hours. Subsequent deviation from the schedule shall require ten (10) working days' advance notice from the first affected date. The Railroad will furnish such personnel or other protective devices:

- (a) When equipment is standing or being operated within 25 feet, measured horizontally, from centerline of any track on which trains may operate, or when any erection or construction activities are in progress within such limits, regardless of elevation above or below track.
- (b) For any excavation below elevation of track subgrade if, in the opinion of the Railroad's representative, track or other Railroad facilities may be subject to settlement or movement.
- (c) During any clearing, grubbing, grading or blasting in proximity to the Railroad which, in the opinion of the Railroad's representative, may endanger the Railroad facilities or operations.
- (d) During any of the Contractor's operations when, in the opinion of the Railroad's representatives, the Railroad facilities, including, but not limited to, tracks, buildings, signals, wire lines or pipe lines, may be endangered.

The cost of flagging and inspection provided by the Railroad during the period of constructing that portion of the project located on or near the Railroad property, as deemed necessary for the protection of the Railroad's facilities and trains, will be borne by the State. The Railroad has indicated that its estimated flagging rate will be around One Thousand One Hundred Dollars (\$1,100.00) per day. The State shall pay the Railroad for all actual flagging costs incurred by the Railroad under this Project.

### **13-1.04 WORK BY RAILROAD**

The following work by the Railroad will be performed by Railroad forces and is not a part of the work under this Contract.

- (a) The Railroad will perform preliminary engineering and inspection (if any) and flagging as specified in Section 13-1.03 "Protection of Railroad Facilities," of these special provisions.

- (b) Temporary crossings at grade over tracks of Railroad for the purpose of hauling earth, rock, paving or other materials will not be permitted. If the Contractor, for the purpose of constructing highway-railway grade separation structures, including construction ramps thereto, desires to move equipment or materials across Railroad's tracks, the Contractor shall first obtain permission from Railroad via the State Engineer. Should Railroad approve the temporary crossing, State shall execute a Service Contract with Railroad for Railroad to construct the temporary crossing. Under the Service Contract, State shall bear the cost of the crossing surface, warning devices and other components that might be required. Notwithstanding State's Service Contract with Railroad, the Contractor is required to execute Railroad's form of Contractor's Haul Road Crossing Agreement. Railroad, at State's expense, shall provide flagmen to control movements of vehicles across the temporary crossing. State and its Contractor shall prevent the use of such temporary crossing by unauthorized persons and vehicles.

### **13-1.05 DELAYS DUE TO WORK BY RAILROAD.**

If delays due to work by the Railroad occur, and the Contractor sustains loss which, in the opinion of the Engineer, could not have been avoided by the judicious handling of forces, equipment and plant, the amount of said loss shall be determined as provided in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

If a delay due to work by the Railroad occurs, an extension of time determined pursuant to the provisions in Section 8-1.07, "Liquidated Damages," of the Standard Specifications will be granted.

### **13-1.06 LEGAL RELATIONS**

The provisions of Section 13-1, "Relations with Railroad Company," and the provisions of Section 13-2, "Railroad Protective Insurance," of these special provisions shall inure directly to the benefit of the Railroad.

### **13-2 RAILROAD PROTECTIVE INSURANCE**

In addition to any other form of insurance or bonds required under the terms of the contract and specifications, the Contractor will be required to carry insurance of the kinds and in the amounts hereinafter specified.

Such insurance shall be approved by the Railroad before any work is performed on the Railroad's property and shall be carried until all work required to be performed on or adjacent to the Railroad's property under the terms of the contract is satisfactorily completed as determined by the Engineer, and thereafter until all tools, equipment and materials have been removed from the Railroad's property and such property is left in a clean and presentable condition.

Full compensation for all premiums which the Contractor is required to pay on all the insurance described hereinafter shall be considered as included in the prices paid for the various items of work to be performed under the contract, and no additional allowance will be made thereof or for additional premiums which may be required by extensions of the policies of insurance.

The following insurance coverage will be required:

- A. Commercial General Liability** insurance. Commercial general liability (CGL) with a limit of not less than \$2,000,000 each occurrence and an aggregate limit of not less than \$4,000,000. CGL insurance must be written on ISO occurrence form CG 00 01 12 04 (or a substitute form providing equivalent coverage).  
The policy must also contain the following endorsement, which must be stated on the certificate of insurance:  
Contractual Liability Railroads ISO form CG 24 17 10 01 (or a substitute form providing equivalent coverage) showing "Union Pacific Railroad Company Property" as the Designated Job Site.
- B. Business Automobile Coverage** insurance. Business auto coverage written on ISO form CA 00 01 (or a substitute form providing equivalent liability coverage) with a combined single limit of not less \$1,000,000 for each accident.  
The policy must contain the following endorsements, which must be stated on the certificate of insurance:
- Coverage For Certain Operations In Connection With Railroads ISO form CA 20 70 10 01 (or a substitute form providing equivalent coverage) showing "Union Pacific Property" as the Designated Job Site.
  - Motor Carrier Act Endorsement - Hazardous materials clean up (MCS-90) if required by law.
  -
- C. Workers' Compensation and Employers' Liability** insurance. Coverage must include but not be limited to:
- Contractor's statutory liability under the workers' compensation laws of the State of California.
  - Employers' Liability (Part B) with limits of at least \$500,000 each accident, \$500,000 disease policy limit \$500,000 each employee.

If Contractor is self-insured, evidence of state approval and excess workers compensation coverage must be provided. Coverage must include liability arising out of the U. S. Longshoremen's and Harbor Workers' Act, the Jones Act, and the Outer Continental Shelf Land Act, if applicable.

The policy must contain the following endorsement, which must be stated on the certificate of insurance:

- Alternate Employer endorsement ISO form WC 00 03 01 A (or a substitute form providing equivalent coverage) showing Railroad in the schedule as the alternate employer (or a substitute form providing equivalent coverage).
- D. Railroad Protective Liability** insurance. Contractor must maintain Railroad Protective Liability insurance written on ISO occurrence form CG 00 35 12 04 (or a substitute form providing equivalent coverage) on behalf of Railroad as named insured, with a limit of not less than \$2,000,000 per occurrence and an aggregate of \$6,000,000. A binder stating the policy is in place must be submitted to Railroad before the work may be commenced and until the original policy is forwarded to Railroad.
- E. Umbrella or Excess** insurance. If Contractor utilizes umbrella or excess policies, these policies must “follow form” and afford no less coverage than the primary policy.
- F. Pollution Liability** insurance. Pollution liability coverage must be written on ISO form Pollution Liability Coverage Form Designated Sites CG 00 39 12 04 (or a substitute form providing equivalent liability coverage), with limits of at least \$5,000,000 per occurrence and an aggregate limit of \$10,000,000.

If the scope of work as defined in this Agreement includes the disposal of any hazardous or non-hazardous materials from the job site, Contractor must furnish to Railroad evidence of pollution legal liability insurance maintained by the disposal site operator for losses arising from the insured facility accepting the materials, with coverage in minimum amounts of \$1,000,000 per loss, and an annual aggregate of \$2,000,000.

#### **Other Requirements**

- G.** All policy(ies) required above (except worker’s compensation and employers liability) must include Railroad as “Additional Insured” using ISO Additional Insured Endorsements CG 20 26, and CA 20 48 (or substitute forms providing equivalent coverage). The coverage provided to Railroad as additional insured shall, to the extent provided under ISO Additional Insured Endorsement CG 20 26, and CA 20 48 provide coverage for Railroad’s negligence whether sole or partial, active or passive, and shall not be limited by Contractor's liability under the indemnity provisions of this Agreement.
- H.** Before Contractor commences any work, the Contractor shall, except to the extent prohibited by law; (1) require each of its subcontractors to include the Contractor as “Additional Insured” in the subcontractor’s Commercial Liability policy and Business Automobile policies with respect to all liabilities arising out of the subcontractors performance of work on behalf of the Contractor by endorsing these policies with ISO Additional Insured Endorsements CG 20 26, and CA 20 48 (or substitute forms providing equivalent coverage; (2) require each of its subcontractors to endorse their Business Automobile Policy with “Coverage for Certain Operations in Connection With Railroads” ISO Form CA 20 70 10 01 (or a substitute form providing equivalent coverage) for the job site.
- I.** Punitive damages exclusion, if any, must be deleted (and the deletion indicated on the certificate of insurance), unless the law governing this Agreement prohibits all punitive damages that might arise under this Agreement.
- J.** Contractor waives all rights of recovery, and its insurers also waive all rights of subrogation of damages against Railroad and its agents, officers, directors and employees. This waiver must be stated on the certificate of insurance.
- K.** Prior to commencing the work, Contractor shall furnish Railroad with a certificate(s) of insurance, executed by a duly authorized representative of each insurer, showing compliance with the insurance requirements in this Agreement.
- L.** All insurance policies must be written by a reputable insurance company acceptable to Railroad or with a current Best's Insurance Guide Rating of A- and Class VII or better, and authorized to do business in the State of California.
- M.** The fact that insurance is obtained by Contractor or by Railroad on behalf of Contractor will not be deemed to release or diminish the liability of Contractor, including, without limitation, liability under the indemnity provisions of this Agreement. Damages recoverable by Railroad from Contractor or any third party will not be limited by the amount of the required insurance coverage.

**AMENDMENTS TO THE STANDARD SPECIFICATIONS  
DATED MAY 2006**

## AMENDMENTS ISSUE DATE: 09-16-11

### SECTION 0 GLOBAL REVISIONS

(Issued 06-05-09)

Global revisions are changes to contract documents not specific to a section of the Standard Specifications. In each contract document at each occurrence, interpret the following terms as shown:

Term	Interpretation	Conditions
AC	HMA	1. Where AC means asphalt concrete 2. Except where existing AC is described
Asphalt concrete	Hot mix asphalt	Except where existing asphalt concrete is described
Class 1 concrete	Concrete containing not less than 675 pounds of cementitious material per cubic yard	--
Class 2 concrete	Concrete containing not less than 590 pounds of cementitious material per cubic yard	--
Class 3 concrete	Concrete containing not less than 505 pounds of cementitious material per cubic yard	--
Class 4 concrete	Concrete containing not less than 420 pounds of cementitious material per cubic yard	--
Clause providing an option to use either a class concrete or minor concrete	Use minor concrete	--
Clause referring to a delay as a right-of-way delay	Delay under Section 8-1.09, "Delays"	--
Contact joint	Construction joint	--
Controlling operation	Controlling activity	--
Engineer's Estimate	Verified Bid Item List	--
Engineering fabrics	Geosynthetics	--
Notice to Contractors	Notice to Bidders	--
Partial payments	Progress payments	Except in Section 9-1.07D, "Mobilization"
PCC pavement	Concrete pavement	Except where existing PCC pavement is described
Portland cement concrete pavement	Concrete pavement	Except where existing portland cement concrete pavement is described
Project information	Supplemental project information	Except in "Contract Project Information Signs"
Reference to a working day or non-working day under Section 8-1.06, "Time of Completion"	Working day as defined in Section 1-4.02, "Glossary"	--
Section 9-1.015	Section 9-1.01C	--
Section 86, "Signal, Lighting and Electrical Systems"	Section 86, "Electrical Systems"	--
Section 86-2.07, "Traffic Pull Boxes"	Section 86-2.06, "Pull Boxes"	



Headings are included for the purposes of organization and referencing. Inclusion of a heading with no related content, "Reserved," or "Not Used" does not indicate that no specification exists for that subject; applicable specifications may be covered in a general or referenced specification.

## **1-2 REFERENCES**

### **1-2.01 REFERENCES**

Where Standard Specifications refer to the special provisions to describe the work, interpret the reference as a reference to the Bid Item List, the special provisions, or both.

Interpret a reference to a section of the Standard Specifications as a reference to the Standard Specifications as revised by any amendment, special provision, or both.

A reference within parentheses to a law or regulation is included in the contract for convenience only and is not a comprehensive listing of related laws and regulations. Lack of a reference does not indicate no related laws or regulations exist.

Where the version of a referenced document is not specified, use the current version in effect on the date of Notice to Bidders.

A reference to a subsection includes the section's general specifications of which the subsection is a part.

A code not specified as a Federal code is a California code.

### 1-3 ABBREVIATIONS AND MEASUREMENT UNITS

#### 1-3.01 ABBREVIATIONS

<b>Abbreviations</b>	
Abbreviation	Meaning
AAN	American Association of Nurserymen
AASHTO	American Association of State Highway and Transportation Officials
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMA	archaeological monitoring area
ANSI	American National Standards Institute
APHA	American Public Health Association
API	American Petroleum Institute
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWG	American Wire Gage
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
CIH	Certified Industrial Hygienist
DBE	Disadvantaged Business Enterprise
DVBE	Disabled Veteran Business Enterprise
EIA	Electronic Industries Alliance
ESA	environmentally sensitive area
ETL	Electrical Testing Laboratories
(F)	final pay item
FHWA	Federal Highway Administration
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NEC	National Electrical Code
NETA	National Electrical Testing Association, Inc.
NEMA	National Electrical Manufacturers Association
PLAC	permit, license, agreement, certification, or any combination of these
RFI	request for information
SSPC	The Society for Protective Coatings
TIA	time impact analysis
UL	Underwriters' Laboratories Inc.

### 1-3.02 MEASUREMENT UNITS

<b>Measurement Units</b>		
Symbols as used in the specifications	Symbols as used in the Bid Item List	Meaning
A	—	amperes
	ACRE	acre
	CF	cubic foot
	CY	cubic yard
--	EA	each
g	--	gram
ksi	--	kips per square inch
	GAL	gallon
h	H	hour
	LB	pound
--	LS	lump sum
	LF	linear foot
	LNMI	lane mile
	MFBM	thousand foot board measure
	MI	mile
	MSYD	thousand station yard
Ω	--	ohm
pcf	--	pounds per cubic foot
s	--	second
	STA	100 feet
	SQFT	square foot
	SQYD	square yard
	TAB	tablet
ton	TON	2,000 pounds
V	--	volt
W	--	watt
--	WDAY	working day

### 1-4 DEFINITIONS

#### 1-4.01 GENERAL

Interpret terms as defined in the contract documents. A construction-industry term not defined in the contract documents has the meaning defined in Means Illustrated Construction Dictionary, Condensed Version, Second Edition.

#### 1-4.02 GLOSSARY

**aerially deposited lead:** Lead primarily from vehicle emissions deposited within unpaved areas or formerly unpaved areas.

**archaeological monitoring area:** Area within, near, or straddling the project limits where access is allowed, but work is subject to archaeological monitoring.

**archaeological resources:** Remains of past human activity, including historic and prehistoric material (e.g., tools and tool fragments, hearth and food remains, structural remains, and human remains).

**acceptance:** Formal written acceptance by the Director of an entire contract that has been completed in all respects in accordance with the plans and specifications and any modifications to them previously approved.

**base:** Layer of specified material of planned thickness placed immediately below the pavement or surfacing.

**basement material:** Material in excavation or embankments underlying the lowest layer of subbase, base, pavement, surfacing, or other specified layer to be placed.

**bid item:** Specific work unit for which the bidder provides a price.

**Bid Item List:** List of bid items and the associated quantities.

**Bid Item List, verified:** Bid Item List with verified prices. The Contract Proposal of Low Bidder at the Department's Web site is the verified Bid Item List.

**bridge:** Structure, with a bridge number, that carries a utility facility, or railroad, highway, pedestrian or other traffic, over a water course or over or under or around any obstruction.

**building-construction contract:** Contract that has "building construction" on the cover of the Notice to Bidders and Special Provisions.

**business day:** Day on the calendar except Saturday or holiday.

**California Manual on Uniform Traffic Control Devices:** The California Manual on Uniform Traffic Control Devices for Streets and Highways (California MUTCD) is issued by the Department of Transportation and is the Federal Highway Administration's MUTCD 2003 Edition, as amended for use in California.

**Certified Industrial Hygienist:** Industrial hygienist certified in comprehensive practice by the American Board of Industrial Hygiene.

**conduit:** Pipe or tube in which smaller pipes, tubes, or electrical conductors are inserted or are to be inserted.

**contract:** Written and executed contract between the Department and the Contractor.

**contract bonds:** Security for the payment of workers and suppliers furnishing materials, labor, and services and for guaranteeing the Contractor's work performance.

**contract item:** Bid item.

**Contractor:** Person or business or its legal representative entering into a contract with the Department for performance of the work.

**culvert:** Structure, other than a bridge, that provides an opening under a roadway for drainage or other purposes.

**day:** 24 consecutive hours running from midnight to midnight; calendar day.

**deduction:** Amount of money permanently taken from progress payment and final payment. Deductions are not retentions under Pub Cont Code § 7107.

**Department:** Department of Transportation as defined in St & Hwy Code § 20 and authorized in St & Hwy Code § 90; its authorized representatives.

**detour:** Temporary route for traffic around a closed road part. A passageway through a job site is not a detour.

**Director:** Department's Director.

**Disabled Veteran Business Enterprise:** Business certified as a DVBE by the Office of Small Business and DVBE Services, Department of General Services.

**divided highway:** Highway with separated traveled ways for traffic, generally in opposite directions.

**Engineer:** Department's Chief Engineer acting either directly or through properly authorized agents; the agents acting within the scope of the particular duties delegated to them.

**environmentally sensitive area:** Area within, near, or straddling the project limits where access is prohibited or limited to protect environmental resources.

**Federal-aid contract:** Contract that has a Federal-aid project number on the cover of the Notice to Bidders and Special Provisions.

**fixed costs:** Labor, material, or equipment cost directly incurred by the Contractor as a result of performing or supplying a particular bid item that remains constant regardless of the item's quantity.

**frontage road:** Local street or road auxiliary to and located generally on the side of an arterial highway for service to abutting property and adjacent areas and for control of access.

**grading plane:** Basement material surface on which the lowest layer of subbase, base, pavement, surfacing, or other specified layer is placed.

**highway:** Whole right of way or area that is reserved for and secured for use in constructing the roadway and its appurtenances.

**holiday:**

1. Every Sunday
2. January 1st, New Year's Day
3. 3rd Monday in January, Birthday of Martin Luther King, Jr.
4. February 12th, Lincoln's Birthday
5. 3rd Monday in February, Washington's Birthday
6. March 31st, Cesar Chavez Day
7. Last Monday in May, Memorial Day
8. July 4th, Independence Day
9. 1st Monday in September, Labor Day
10. 2nd Monday in October, Columbus Day
11. November 11th, Veterans Day
12. 4th Thursday in November, Thanksgiving Day
13. Day after Thanksgiving Day
14. December 25th, Christmas Day

If January 1st, February 12th, March 31st, July 4th, November 11th, or December 25th falls on a Sunday, the Monday following is a holiday. If November 11th falls on a Saturday, the preceding Friday is a holiday. Interpret "legal holiday" as "holiday."

**idle equipment:** Equipment:

1. On the job site at the start of a delay
2. Idled because of the delay
3. Not operated during the delay

**informal-bid contract:** Contract that has "Informal Bid Authorized by Pub Cont Code §10122" on the cover of the Notice to Bidders and Special Provisions.

**Information Handout:** Supplemental project information furnished to bidders as a handout.

**laboratory:** Laboratory authorized by the Department to test materials.

**liquidated damages:** Amount prescribed in the specifications, pursuant to the authority of Pub Cont Code § 10226, to be paid to the State or to be deducted for each day's delay in completing the whole or any specified portion of the work beyond the time allowed in the specifications.

**listed species:** Any species listed as threatened or endangered under (1) Federal Endangered Species Act of 1973, 16 USC §1531 et seq., (2) California Endangered Species Act, Fish & Game Code §§ 2050–2115.5, (3) or both.

**material shortage:** Shortage of raw or produced material that is area-wide and caused by an unusual market condition, except if any of the following occurs:

1. Shortage relates to a produced, nonstandard material
2. Supplier's and the Contractor's priority for filling an order differs
3. Event outside the U.S. for a material produced outside the U.S.

**median:** Portion of a divided highway separating the traveled ways for traffic in opposite directions including inside shoulders.

**mobilization:** Preparatory work that must be performed or costs incurred before starting work on the various items on the job site (Pub Cont Code § 10104).

**Notice to Bidders:** Document that provides a general work description, bidder and bid specifications, and the time and location the Department receives bids.

**paleontological resources:** Fossils and the deposits they are found in. Fossils are evidence of ancient life preserved in sediments and rock. Examples of paleontological resources are remains of (1) animals, (2) animal tracks, (3) plants, and (4) other organisms. Archaeological resources are not paleontological and fossils found within an archaeological resource are generally considered archaeological resources, not paleontological resources.

**pavement:** Uppermost layer of material placed on the traveled way or shoulders. This term is used interchangeably with surfacing.

**permitted biological activities:** Monitoring, surveying, or other practices that require a take permit and project specific permission from U.S. Fish and Wildlife Service or NOAA Fisheries or a take permit or Memorandum of Understanding with Department of Fish and Game.

**plans:** Official project plans and Standard Plans, profiles, typical cross sections, working drawings and supplemental drawings, or reproductions thereof, approved by the Engineer, which show the location, character, dimensions and details of the work to be performed. These documents are to be considered as a part of the plans.

In the above definition, the following terms are defined as follows:

**Standard Plans:** Standard Plans issued by the Department.

**project plans:** Specific details and dimensions peculiar to the work supplemented by the Standard Plans insofar as the same may apply.

**protective radius:** Minimum distance between construction activities and regulated species.

**regulated species:** Any species protected by one or any combination of the following:

1. Federal Endangered Species Act of 1973, 16 USC §1531 et seq.
2. California Endangered Species Act, Fish & Game Code §§2050–2115.5
3. Fish & Game Code §§1600–1616
4. National Environmental Policy Act, 42 USC §4321 et seq.
5. California Environmental Quality Act, Pub Res Code § 21000 et.seq.
6. Other law or regulation that governs activities that affect species or their habitats.

**roadbed:** Area between the intersection of the upper surface of the roadway and the side slopes or curb lines. The roadbed rises in elevation as each increment or layer of subbase, base, surfacing or pavement is placed. Where the medians are so wide as to include areas of undisturbed land, a divided highway is considered as including 2 separate roadbeds.

**roadway:** Highway portion included between the outside lines of sidewalks, or curbs, slopes, ditches, channels, waterways, and including all the appertaining structures, and other features necessary to proper drainage and protection.

- routine biological activities:** Biological monitoring, surveying, or other activity that does not require a take permit from the U.S. Fish and Wildlife Service or NOAA Fisheries or a take permit or Memorandum of Understanding with Department of Fish and Game.
- service-approved biologist:** Biologist whose activities must be approved by a state or federal agency as provided in PLACs.
- shoulder:** Roadway portion contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.
- small tool:** Tool or piece of equipment not listed in Labor Surcharge and Equipment Rental Rates that has a replacement value of \$500 or less.
- special provisions:** Specific clauses setting forth conditions or requirements peculiar to the work and supplementary to these Standard Specifications. The Department's publication titled "Labor Surcharge And Equipment Rental Rates" is part of the special provisions.
- specifications:** Directions, provisions, and requirements contained in these Standard Specifications, Amendments to the Standard Specifications, and the special provisions. Where the term "these specifications" or "these Standard Specifications" is used in this book, it means the provisions set forth in this book.
- State:** State of California, including its agencies, departments, or divisions, whose conduct or action is related to the work.
- Structure Design:** Offices of Structure Design of the Department.
- subbase:** Layer of specified material of planned thickness between a base and the basement material.
- subgrade:** Roadbed portion on which pavement, surfacing, base, subbase, or a layer of any other material is placed.
- substructure:** Bridge portions below the bridge seats, tops of piers, haunches of rigid frames, or below the spring lines of arches. Backwalls and parapets of abutments and wingwalls of bridges are portions of the substructure.
- superstructure:** Bridge portion except the bridge substructure.
- supplemental project information:** Information relevant to the project, specified as supplemental project information, and made available to bidders.
- surfacing:** Uppermost layer of material placed on the traveled way, or shoulders. This term is used interchangeably with pavement.
- take:** Legal definition regarding harm to listed species as defined in 16 USC §1532 and Fish & Game Code § 86.
- take permit:** Permit granted by the US Fish and Wildlife Service or by the NOAA Fisheries that allows take of federal listed species under 16 USC §1539 or by the Department of Fish & Game that allows take of state listed species under to Fish & Game Code § 2081.
- traffic lane:** Portion of a traveled way for the movement of a single line of vehicles.
- traveled way:** Portion of the roadway for the movement of vehicles, exclusive of shoulders.
- total bid:** Sum of the item totals as verified by the Department; original contract price.
- withhold:** Money temporarily or permanently taken from progress payment. Withholds are not retentions under Pub Cont Code § 7107.
- work:** All the work specified, indicated, shown or contemplated in the contract to construct the improvement, including all alterations, amendments, or extensions to it made by contract change order or other written orders of the Engineer.
- working day:** Time measure unit for work progress. A working day is any day except:
1. Saturdays and holidays
  2. A day when you cannot perform work on the controlling activity for at least 50 percent of the day with at least 50 percent of the normal labor and equipment due to any of the following:
    - 2.1. Adverse weather-related conditions that cause you to dismiss the crew
    - 2.2. Maintaining traffic under the contract
    - 2.3. The Engineer's direction to suspend the controlling activities for reasons unrelated to your performance
    - 2.4. An unanticipated event not caused by either party such as:
      - 2.4.1. Act of God (Pub Cont Code § 7105)
      - 2.4.2. Act of a public enemy
      - 2.4.3. Epidemic
      - 2.4.4. Fire
      - 2.4.5. Flood
      - 2.4.6. Governor-declared state of emergency
      - 2.4.7. Landslide
      - 2.4.8. Quarantine restriction

2.5. An issue involving a third-party, including:

2.5.1. Industry or area-wide labor strike

2.5.2. Material shortage

2.5.3. Freight embargo

2.5.4. Jurisdictional requirement of a law enforcement agency

2.5.5. Workforce labor dispute of a utility or non-highway facility owner resulting in a utility or non-highway facility reconstruction not described and not solely for the Contractor's convenience

## 1-5 DISTRICTS

### District Composition and Office Addresses

District	Counties	Location Address	Mailing Address
1	Del Norte (DN), Humboldt (Hum), Lake (Lak), Mendocino (Men)	1656 UNION ST EUREKA, CA	PO BOX 3700 EUREKA CA 95502
2	Lassen (Las), Modoc (Mod), Plumas (Plu), Shasta (Sha), Siskiyou (Sis), Tehama (Teh), Trinity (Tri)	1657 RIVERSIDE DR REDDING, CA	PO BOX 496073 REDDING CA 96049-6073
3	Butte (But), Colusa (Col), El Dorado (ED), Glenn (Gle), Nevada (Nev), Placer (Pla), Sacramento (Sac), Sierra (Sie), Sutter (Sut), Yolo (Yol), Yuba (Yub)	703 B ST MARYSVILLE, CA	PO BOX 911 MARYSVILLE CA 95901
4	Alameda (Ala), Contra Costa (CC), Marin (Mrn), Napa (Nap), San Francisco (SF), San Mateo (SM), Santa Clara (SCI), Solano (Sol), Sonoma (Son)	111 GRAND AVE OAKLAND, CA	PO BOX 23660 OAKLAND CA 94623-0660
5	Monterey (Mon), San Benito (SBt), San Luis Obispo (SLO), Santa Barbara (SB), Santa Cruz (SCr)	50 HIGUERA ST SAN LUIS OBISPO, CA	50 HIGUERA ST SAN LUIS OBISPO CA 93401-5415
6	Fresno (Fre), Kern (Ker), Kings (Kin), Madera (Mad), Tulare (Tul)	1352 W. OLIVE AVE FRESNO, CA	PO BOX 12616 FRESNO CA 93728-2616
7	Los Angeles (LA), Ventura (Ven)	100 S. MAIN ST LOS ANGELES	100 S MAIN ST LOS ANGELES CA 90012
8	Riverside (Riv), San Bernardino (SBd)	464 W 4TH ST SAN BERNARDINO, CA	464 W 4TH ST SAN BERNARDINO CA 92401-1400
9	Inyo (Iny), Mono (Mno)	500 S MAIN ST BISHOP, CA	500 S MAIN ST BISHOP CA 93514-3423
10	Alpine (Alp), Amador (Ama), Calaveras (Cal), Mariposa (Mpa), Merced (Mer), San Joaquin (SJ), Stanislaus (Sta), Tuolumne (Tuo)	1976 E CHARTER WAY STOCKTON, CA	PO BOX 2048 STOCKTON CA 95201
11	Imperial (Imp), San Diego (SD)	4050 TAYLOR ST SAN DIEGO, CA	4050 TAYLOR ST SAN DIEGO CA 92110-2737
12	Orange (Ora)	3347 MICHELSON DR STE 100 IRVINE, CA	3347 MICHELSON DR STE 100 IRVINE CA 92612-0661

A project with work in District 1, 2, or 3 is a North Region project. For Districts 1, 2, and 3, interpret each reference to the district office as the North Region office. The North Region office address is the District 3 address.

**1-6 WEB SITES, ADDRESSES, AND TELEPHONE NUMBERS**

**Web Sites, Addresses, and Telephone Numbers**

Agency, Department Unit, or Reference	Web Site	Address	Telephone No.
Bidders' Exchange	<a href="http://www.dot.ca.gov/hq/esc/oe/bidex">www.dot.ca.gov/hq/esc/oe/bidex</a>	MSC 26 BIDDERS' EXCHANGE DEPARTMENT OF TRANSPORTATION 1727 30TH ST SACRAMENTO CA 95816-7005	(916) 227-6259
Department	<a href="http://www.dot.ca.gov">www.dot.ca.gov</a>		
Department of General Services, Office of Small Business and DVBE Services	<a href="http://www.pd.dgs.ca.gov/smbus/default.htm">www.pd.dgs.ca.gov/smbus/default.htm</a>	OFFICE OF SMALL BUSINESS AND DVBE SERVICES DEPARTMENT OF GENERAL SERVICES 707 3RD ST WEST SACRAMENTO CA 95605-2811	(800) 559-5529 (916) 375-4940
Department of Industrial Relations	<a href="http://www.dir.ca.gov">www.dir.ca.gov</a>		
Department of Industrial Relations, Division of Apprenticeship Standards		455 GOLDEN GATE AVENUE SAN FRANCISCO, CA 94102	
Division of Accounting, Office of External Accounts Payable	<a href="http://www.dot.ca.gov/hq/asc/oap/payments/contact.htm#conpets1">http://www.dot.ca.gov/hq/asc/oap/payments/contact.htm#conpets1</a>	MAJOR CONSTRUCTION PAYMENT AND INFORMATION UNIT OFFICE OF EXTERNAL ACCOUNTS PAYABLE DIVISION OF ACCOUNTING DEPARTMENT OF TRANSPORTATION P.O. BOX 168043 SACRAMENTO, CA 95816-8043	(916) 227-9013
Office Engineer		MSC 43 OFFICE ENGINEER DEPARTMENT OF TRANSPORTATION 1727 30TH ST SACRAMENTO CA 95816-7005	
Office Engineer– Verified Bid Results	<a href="http://www.dot.ca.gov/hq/esc/oe/awards/bidsum_html/6week_list.html">http://www.dot.ca.gov/hq/esc/oe/awards/bidsum_html/6week_list.html</a>		
Offices of Structure Design, Documents Unit		MSC 9-4/4I DOCUMENTS UNIT OFFICES OF STRUCTURE DESIGN DEPARTMENT OF TRANSPORTATION 1801 30TH ST SACRAMENTO CA 95816-7006	(916) 227-0716



1. District-County-Route
2. Contract number
3. Viewing date
4. Contact information, including telephone number.

For rock cores, also include the bridge number in your request.  
If bridge as-built drawings are available:

1. For a project in District 1 through 6 or 10, you may request them from the Office of Structure Maintenance and Investigations, fax (916) 227-8357
2. For a project in District 7, 8, 9, 11, or 12, you may request them from the Office of Structure Maintenance and Investigations, fax (916) 227-8357, and are available at the Office of Structure Maintenance and Investigations, Los Angeles, CA, telephone (213) 897-0877

As-built drawings may not show existing dimensions and conditions. Where new construction dimensions are dependent on existing bridge dimensions, verify the field dimensions and adjust dimensions of the work to fit existing conditions.

## **2-1.04–2-1.10 RESERVED**

### **2-1.11 JOB SITE AND DOCUMENT EXAMINATION**

Examine the job site and bid documents.

Bid submission is your acknowledgment that you have examined the job site and bid documents and are satisfied with:

1. General and local conditions to be encountered
2. Character, quality, and scope of work to be performed
3. Quantities of materials to be furnished
4. Character, quality, and quantity of surface and subsurface materials or obstacles
5. Requirements of the contract

### **2-1.12 BID DOCUMENT COMPLETION**

#### **2-1.12A General**

Complete forms in the Bid book.

On the Subcontractor List you may either submit each subcontracted bid item number and corresponding percentage with your bid or fax this information to (916) 227-6282 within 24 hours after bid opening. If you fail to submit this information within the time specified, your bid is nonresponsive.

Except for the bid item number and the percentage of each item subcontracted, do not fax submittals.

#### **2-1.12B Bid Item List and Bid Comparison**

Submit a bid based on the work item quantities the Department shows in the Bid Item List.

For a lump sum based bid, the Department compares bids based on the total price.

For a unit price based bid, the Department compares bids based on the sum of the item totals.

For a cost plus time based bid, the Department compares bids based on the sum of the item totals and the total bid for time. If your bid for time exceeds the number of working days described in the Notice to Bidders, your bid is nonresponsive.

#### **2-1.12C Subcontractor List**

In the Subcontractor List, list each subcontractor to perform work in an amount in excess of 1/2 of 1 percent of the total bid or \$10,000, whichever is greater (Pub Cont Code § 4100 et seq.)

The Subcontractor List must show the name, address, and work portions to be performed by each subcontractor listed. Show work portion by bid item number, description, and percentage of each bid item subcontracted.

### **2-1.13 BIDDER'S SECURITY**

Submit your bid with one of the following forms of bidder's security equal to at least 10 percent of the bid:

1. Cash
2. Cashier's check
3. Certified check
4. Bidder's bond signed by a surety insurer who is licensed in California



**Replace Section 3 with:**  
**SECTION 3 CONTRACT AWARD AND EXECUTION**

**3-1.01 SCOPE**

Section 3, "Contract Award and Execution," includes specifications related to contract award and execution.

**3-1.02 CONTRACT AWARD**

Submit any bid protest to the Office Engineer.

If the Department awards the contract, the award is made to the lowest responsible bidder within the number of days shown in the following table:

<b>Contract Award Period</b>	
Days (after bid opening)	Project Estimated Cost shown in the Notice to Bidders
30	< \$200 million
60	≥ \$200 million

The Department may extend the specified award period if the bidder agrees.

**3-1.03 CONTRACT BONDS (PUB CONT CODE §§ 10221 AND 10222)**

The successful bidder must furnish:

1. Payment bond to secure the claim payments of laborers, workers, mechanics, or materialmen providing goods, labor, or services under the contract. This bond must be equal to at least 100 percent of the total bid.
2. Performance bond to guarantee the faithful performance of the contract. This bond must be equal to at least 50 percent of the total bid.

The Department furnishes the successful bidder with the bond forms.

**3-1.04 CONTRACTOR LICENSE**

For a Federal-aid contract, the Bidder must be properly licensed (Pub Cont Code § 10164) from contract award through contract acceptance.

For a non-Federal-aid contract:

1. The Bidder must be properly licensed from bid opening through contract acceptance (Bus & Prof Code § 7028.15)
2. Joint venture bidders must obtain a joint venture license before contract award (Bus & Prof Code § 7029.1)

**3-1.05 INSURANCE POLICIES**

The successful bidder must submit:

1. Copy of its commercial general liability policy and its excess policy or binder until such time as a policy is available, including the declarations page, applicable endorsements, riders, and other modifications in effect at the time of contract execution. Standard ISO form No. CG 0001 or similar exclusions are allowed if not inconsistent with Section 7-1.12, "Indemnification and Insurance." Allowance of additional exclusions is at the discretion of the Department.
2. Certificate of insurance showing all other required coverages. Certificates of insurance, as evidence of required insurance for the auto liability and any other required policy, shall set forth deductible amounts applicable to each policy and all exclusions that are added by endorsement to each policy. The evidence of insurance shall provide that no cancellation, lapse, or reduction of coverage will occur without 10 days prior written notice to the Department.
3. A declaration under the penalty of perjury by a CPA certifying the accountant has applied GAAP guidelines confirming the successful bidder has sufficient funds and resources to cover any self-insured retentions if the self-insured retention is over \$50,000.

If the successful bidder uses any form of self-insurance for workers compensation in lieu of an insurance policy, it shall submit a certificate of consent to self-insure under Labor Code § 3700.

**3-1.06–3-1.08 RESERVED**

**3-1.09 CONTRACT EXECUTION**

The successful bidder must sign the contract and return it to the Office Engineer along with:

1. Contract bonds
2. Documents identified in Section 3-1.05, "Insurance Policies"

For an informal-bid contract, the Office Engineer must receive these documents before the 5th business day after the bidder receives the contract. For all other contracts, the Office Engineer must receive these documents before the 10th business day after the bidder receives the contract.

The bidder's security may be forfeited for failure to execute the contract within the time specified (Pub Cont Code §§ 10181, 10182, and 10183).

The following is a copy of the Contract form:



STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION  
CONTRACT NO. \_\_\_\_\_

This contract is entered into between the State of California's Department of Transportation and the Contractor named below:

\_\_\_\_\_  
CONTRACTOR'S NAME

The parties agree to comply with the terms of the following exhibits that are by this reference made a part of this contract.

- Exhibit A - Bid book dated \_\_\_\_\_
- Exhibit B - Notice to Bidders and Special Provisions dated \_\_\_\_\_
- Exhibit C - Project Plans approved \_\_\_\_\_
- Exhibit D - Standard Specifications dated \_\_\_\_\_
- Exhibit E - Standard Plans dated \_\_\_\_\_
- Exhibit F - Addenda \_\_\_\_\_

Exhibits A, B, C, and F are those exhibits identified with the same contract number as this contract.

**This contract has been executed by the following parties:**

\_\_\_\_\_  
**CONTRACTOR**

CONTRACTOR'S NAME *(if other than an individual, state whether a corporation, partnership, etc.)*

BY *(Authorized Signature)* \_\_\_\_\_ DATE SIGNED *(Do not type)* \_\_\_\_\_

PRINTED NAME AND TITLE OF PERSON SIGNING \_\_\_\_\_

FEDERAL EMPLOYER IDENTIFICATION NUMBER \_\_\_\_\_ LICENSE NUMBER \_\_\_\_\_

\_\_\_\_\_  
**DEPARTMENT OF TRANSPORTATION**

BY *(Authorized Signature)* \_\_\_\_\_ DATE SIGNED *(Do not type)* \_\_\_\_\_

PRINTED NAME AND TITLE OF PERSON SIGNING \_\_\_\_\_

**This contract has been certified as complying with the State Contract Act:**

BY *(Authorized Signature)* \_\_\_\_\_ DATE SIGNED *(Do not type)* \_\_\_\_\_

PRINTED NAME AND TITLE OF PERSON SIGNING \_\_\_\_\_

**ADA Notice** For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 654-6410 or TDD (916) 654-3880 or write Records and Forms Management, 1120 N Street, MS-89, Sacramento, CA 95814.

**3-1.10 BIDDERS' SECURITIES**

The Department keeps the securities of the 1st, 2nd, and 3rd low bidders until the contract has been executed. The other bidders' securities, other than bidders' bonds, are returned upon determination of the 1st, 2nd, and 3rd low bidders, and their bidders' bonds are of no further effect (Pub Cont Code § 10184).



**Add:**

**4-1.035 VALUE ENGINEERING**

**4-1.035A General**

Reserved

**4-1.035B Value Engineering Change Proposal**

You may submit a VECP to reduce any of the following:

1. Total cost of construction
2. Construction activity duration
3. Traffic congestion

Before preparing a VECP, meet with the Engineer to discuss:

1. Proposal concept
2. Permit issues
3. Impact on other projects
4. Project impacts, including traffic, schedule, and later stages
5. Peer reviews
6. Overall proposal merits
7. Review times required by the Department and other agencies

The VECP must not impair the project's essential functions or characteristics, such as:

1. Service life
2. Operation economy
3. Maintenance ease
4. Desired appearance
5. Design and safety

The VECP must include:

1. Description of the contract specifications and drawing details for performing the work and the proposed changes.
2. Itemization of contract specifications and drawing details that would be changed.
3. Detailed cost estimate for performing the work under the existing contract and under the proposed change. Determine the estimates under Section 9-1.03, "Force Account Payment."
4. Deadline for the Engineer to decide on the changes.
5. Bid items affected and resulting quantity changes.

The Department is not required to consider a VECP. If a VECP is similar to a change in the plans or specifications being considered by the Department at the time the proposal is submitted or if the proposal is based on or similar to drawings or specifications adopted by the Department before Contract award, the Department does not accept the VECP and may make these changes without VECP payments.

Until the Department approves a change order incorporating the VECP or parts of it, continue to perform the work under the contract. If the Department does not approve a change order before the deadline stated in the VECP or other date you subsequently stated in writing, the VECP is rejected. The Department does not adjust time or payment for a rejected VECP.

The Department decides whether to accept a VECP and the estimated net construction-cost savings from adopting the VECP or parts of it.

The Department may require you to accept a share of the investigation cost as a condition of reviewing a VECP. After written acceptance, the Department considers the VECP and deducts the agreed cost.

If the Department accepts the VECP or parts of it, the Department issues a change order that:

1. Incorporates changes in the contract necessary to implement the VECP or the parts adopted
2. Includes the Department's acceptance conditions
3. States the estimated net construction-cost savings resulting from the VECP
4. Obligates the Department to pay you 50 percent of the estimated net savings



3. Certifications
4. Decisions
5. Notifications
6. Orders
7. Responses

The Contractor must furnish the following in writing:

1. Assignments
2. Notifications
3. Proposals
4. Reports
5. Requests, including RFIs, sequentially numbered
6. Subcontracts
7. Test results

The Department rejects a form if it has any error or any omission.

Convert foreign language documents to English.

Use contract administration forms available at the Department's Web site.

If the last day for submitting a document falls on a Saturday or holiday, it may be submitted on the next business day with the same effect as if it had been submitted on the day specified.

**Add to 5-1.01:**

Failure to enforce a contract provision does not waive enforcement of any contract provision.

**Add:**

**5-1.011 PROTESTS**

You may protest an Engineer's decision by submitting an RFI under Section 5-1.145, "Requests for Information."

**Add:**

**5-1.012 PARTNERING**

**5-1.012A General**

The Department strives to work cooperatively with all contractors; partnering is our way of doing business. The Department encourages project partnering among the project team, made up of significant contributors from the Department and the Contractor, and their invited stakeholders.

For a project with a total bid greater than \$1 million, professionally facilitated project partnering is encouraged.

For a project with a total bid greater than \$10 million, professionally facilitated project partnering is required.

In implementing project partnering, you and the Engineer manage the contract by:

1. Using early and regular communication with involved parties
2. Establishing and maintaining a relationship of shared trust, equity, and commitment
3. Identifying, quantifying, and supporting attainment of mutual goals
4. Developing strategies for using risk management concepts
5. Implementing timely communication and decision making
6. Resolving potential problems at the lowest possible level to avoid negative impacts
7. Holding periodic partnering meetings and workshops as appropriate to maintain partnering relationships and benefits throughout the life of the project
8. Establishing periodic joint evaluations of the partnering process and attainment of mutual goals

Partnering does not void any contract part.

The Department's "Field Guide to Partnering on Caltrans Construction Projects" current at the time of bid is available to the project team as reference. This guide provides structure, context, and clarity to the partnering process requirements. This guide is available at the Department's Partnering Program website:

In implementing project partnering, the project team must:

1. Create a partnering charter that includes:
  - 1.1. Mutual goals, including core project goals and may also include project-specific goals and mutually supported individual goals.
  - 1.2. Partnering maintenance and close-out plan.
  - 1.3. Dispute resolution plan that includes a dispute resolution ladder and may also include use of facilitated dispute resolution sessions.
  - 1.4. Team commitment statement and signatures.
2. Participate in monthly partnering evaluation surveys to measure progress on mutual goals and may also measure short-term key issues as they arise.
3. Evaluate the partnering facilitator on Forms CEM-5501 and CEM-5502. The Engineer provides the evaluation forms to the project team and collects the results. The Department makes evaluation results available upon request. Facilitator evaluations must be completed:
  - 3.1. At the end of the initial partnering workshop on Form CEM-5501.
  - 3.2. At the end of the project close-out partnering workshop on Form CEM-5502.
4. Conduct a project close-out partnering workshop.
5. Document lessons learned before contract acceptance.

#### **5-1.012B Partnering Facilitator, Workshops, and Monthly Evaluation Surveys**

The Engineer sends you a written invitation to enter into a partnering relationship after contract approval. Respond within 15 days to accept the invitation and request the initial and additional partnering workshops. After the Engineer receives the request, you and the Engineer cooperatively:

1. Select a partnering facilitator that offers the service of a monthly partnering evaluation survey with a 5-point rating and agrees to follow the Department's "Partnering Facilitator Standards and Expectations" available at the Department's Partnering Program website
2. Schedule initial partnering workshop
3. Determine initial workshop site and duration
4. Agree to other workshop administrative details

Additional partnering workshops and sessions are encouraged throughout the life of the project as determined necessary by you and the Engineer, recommended quarterly.

#### **5-1.012C Training in Partnering Skills Development**

For a project with a total bid of \$25 million or greater, training in partnering skills development is required.

For a project with a total bid between \$10 million and \$25 million, training in partnering skills is optional.

You and the Engineer cooperatively schedule the training session and select a professional trainer, training site, and 1 to 4 topics from the following list to be covered in the training:

1. Active Listening
2. Building Teams
3. Change Management
4. Communication
5. Conflict Resolution
6. Cultural Diversity
7. Dealing with Difficult People
8. Decision Making
9. Effective Escalation Ladders
10. Emotional Intelligence
11. Empathy
12. Ethics
13. Facilitation Skills

14. Leadership
15. Partnering Process and Concepts
16. Project Management
17. Project Organization
18. Problem Solving
19. Running Effective Meetings
20. Time Management
21. Win-Win Negotiation

Before the initial partnering workshop, the trainer conducts a 1-day training session in partnering skills development for the Contractor's and the Engineer's representatives. This training session must be a separate session from the initial partnering workshop and must be conducted locally. The training session must be consistent with the partnering principles under the Department's "Field Guide to Partnering on Caltrans Construction Projects."

Send at least 2 representatives to the training session. One of these must be your assigned representative as specified in Section 5-1.06, "Superintendence," of the Standard Specifications.

#### **5-1.012D Payment**

The Department pays you for:

1. 1/2 of partnering workshops and sessions based on facilitator and workshop site cost
2. 1/2 of monthly partnering evaluation survey service cost
3. Partnering skills development trainer and training site cost

The Department determines the costs based on invoice prices minus any available or offered discounts. The Department does not pay markups on these costs.

The Department does not pay for wages, travel expenses, or other costs associated with the partnering workshops and sessions, monthly partnering evaluation surveys, and training in partnering skills development.

#### **Add:**

#### **5-1.015 RECORDS**

##### **5-1.015A General**

Reserved

##### **5-1.015B Record Retention**

Retain project records from bid preparation through:

1. Final payment
2. Resolution of claims, if any

For at least 3 years after the later of these, retain cost records, including records of:

1. Bid preparation
2. Overhead
3. Payrolls
4. Payments to suppliers and subcontractors
5. Cost accounting

Maintain the records in an organized way in the original format, electronic and hard copy, conducive to professional review and audit.

##### **5-1.015C Record Inspection, Copying, and Auditing**

Make your records available for inspection, copying, and auditing by State representatives for the same time frame specified under Section 5-1.015B, "Record Retention." The records of subcontractors and suppliers must be made available for inspection, copying, and auditing by State representatives for the same period. Before contract acceptance, the State representative notifies the Contractor, subcontractor, or supplier 5 business days before inspection, copying, or auditing.

If an audit is to start more than 30 days after contract acceptance, the State representative notifies the Contractor, subcontractor, or supplier when the audit is to start.

### **5-1.015D Cost Accounting Records**

Maintain cost accounting records for the project distinguishing between the following work cost categories:

1. Work performed based on bid item prices
2. Work performed by change order other than extra work. Distinguish this work by:
  - 2.1. Bid item prices
  - 2.2. Force account
  - 2.3. Agreed price
3. Extra work. Distinguish extra work by:
  - 3.1. Bid item prices
  - 3.2. Force account
  - 3.3. Agreed price
  - 3.4. Specialist billing
4. Work performed under potential claim records
5. Overhead
6. Subcontractors, suppliers, owner-operators, and professional services

Cost accounting records must include:

1. Final cost code lists and definitions
2. Itemization of the materials used and corresponding vendor's invoice copies
3. Direct cost of labor
4. Equipment rental charges
5. Workers' certified payrolls
6. Equipment:
  - 6.1. Size
  - 6.2. Type
  - 6.3. Identification number
  - 6.4. Hours operated

### **5-1.015E Extra Work Bills**

Maintain separate records for costs of work performed by change order.

Within 7 days after performing the work, submit extra work bills using the Department's Internet extra work billing system.

The Contractor submitting and the Engineer approving an extra work bill using the Internet force account work billing system is the same as each party signing the bill.

The Department provides billing system:

1. Training within 30 days of your written request
2. Accounts and user identification to your assigned representatives after a representative has received training

Each representative must maintain a unique password.

### **Replace Section 5-1.04 with:**

#### **5-1.04 CONTRACT COMPONENTS**

A component in one contract part applies as if appearing in each. The parts are complementary and describe and provide for a complete work.

If a discrepancy exists:

1. The governing ranking of contract parts in descending order is:

- 1.1. Special provisions
  - 1.2. Project plans
  - 1.3. Revised Standard Plans
  - 1.4. Standard Plans
  - 1.5. Amendments to the Standard Specifications
  - 1.6. Standard Specifications
  - 1.7. Supplemental project information
2. Written numbers and notes on a drawing govern over graphics
  3. A detail drawing governs over a general drawing
  4. A detail specification governs over a general specification
  5. A specification in a section governs over a specification referenced by that section

If a discrepancy is found or confusion arises, request correction or clarification.

**Add:**

**5-1.055 SUBCONTRACTING**

**5-1.055A General**

No subcontract releases you from the contract or relieves you of your responsibility for a subcontractor's work.

If you violate Pub Cont Code § 4100 et seq., the Department may exercise the remedies provided under Pub Cont Code § 4110. The Department may refer the violation to the Contractors State License Board as provided under Pub Cont Code § 4111.

Except for a building-construction non-federal-aid contract, perform work equaling at least 30 percent of the value of the original total bid with your employees and with equipment owned or rented by you, with or without operators.

Each subcontract must comply with the contract.

The Department encourages you to include a dispute resolution process in each subcontract.

Each subcontractor must have an active and valid State contractor's license with a classification appropriate for the work to be performed (Bus & Prof Code, § 7000 et seq.).

Submit copies of subcontracts upon request.

Before subcontracted work starts, submit a Subcontracting Request form.

Do not use a debarred contractor; a current list of debarred contractors is available at the Department of Industrial Relations' Web site.

Upon request, immediately remove and not again use a subcontractor who fails to prosecute the work satisfactorily.

**Replace Section 5-1.07 with:**

**5-1.07 LINES AND GRADES**

The Engineer places stakes and marks under Chapter 12, "Construction Surveys," of the Department's Surveys Manual. Submit your request for Department-furnished stakes:

1. On a Request for Construction Stakes form. Ensure:
  - 1.1. Requested staking area is ready for stakes
  - 1.2. You use the stakes in a reasonable time
2. A reasonable time before starting an activity using the stakes

Establish priorities for stakes and note priorities on the request.

Preserve stakes and marks placed by the Engineer. If the stakes or marks are destroyed, the Engineer replaces them at the Engineer's earliest convenience and deducts the cost.

**Replace Section 5-1.10 with:**

**5-1.10 EQUIPMENT**

Clearly stencil or stamp at a clearly visible location on each piece of equipment except hand tools an identifying number and:

1. On compacting equipment, its make, model number, and empty gross weight that is either the producer's rated weight or the scale weight
2. On meters and on the load-receiving element and indicators of each scale, the make, model, serial number, and producer's rated capacity

Submit a list:

1. Describing each piece of equipment
2. Showing its identifying number

Upon request, submit producer's information that designates portable vehicle scale capacities.

For proportioning materials, use measuring devices, material plant controllers, and undersupports complying with Section 9-1.01B, "Weighing Equipment and Procedures."

Measuring devices must be tested and approved under California Test 109 in the Department's presence by any of the following:

1. County Sealer of Weights and Measures
2. Scale Service Agency
3. Division of Measurement Standards Official

The indicator over-travel must be at least 1/3 of the loading travel. The indicators must be enclosed against moisture and dust.

Group measuring system dials such that the smallest increment for each indicator can be read from the location at which proportioning is controlled.

**Replace Section 5-1.116 with:**

**5-1.116 DIFFERING SITE CONDITIONS (23 CFR 635.109)**

**5-1.116A Contractor's Notification**

Promptly notify the Engineer if you find either of the following:

1. Physical conditions differing materially from either of the following:
  - 1.1. Contract documents
  - 1.2. Job site examination
2. Physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the contract

Include details explaining the information you relied on and the material differences you discovered.

If you fail to notify the Engineer promptly, you waive the differing site condition claim for the period between your discovery of the differing site condition and your notification to the Engineer.

If you disturb the site after discovery and before the Engineer's investigation, you waive the differing site condition claim.

**5-1.116B Engineer's Investigation and Decision**

Upon your notification, the Engineer investigates job site conditions and:

1. Notifies you whether to resume affected work
2. Decides whether the condition differs materially and is cause for an adjustment of time, payment, or both

You may protest the Engineer's decision.

**Replace Section 5-1.14 with:**

**5-1.14 COST REDUCTION INCENTIVE**

Comply with Section 4-1.035B, "Value Engineering Change Proposal."

**Add:**

### **5-1.145 REQUESTS FOR INFORMATION**

Submit an RFI upon recognition of any event or question of fact arising under the Contract.

The Engineer responds to the RFI within 5 days. Proceed with the work unless otherwise ordered. You may protest the Engineer's response by:

1. Submitting an Initial Potential Claim Record within 5 days after receipt of the Engineer's response
2. Complying with Section 5-1.146, "Potential Claims and Dispute Resolution"

**Add:**

### **5-1.146 POTENTIAL CLAIMS AND DISPUTE RESOLUTION**

#### **5-1.146A General**

Minimize and mitigate impacts of potentially claimed work or event.

For each potential claim, assign an identification number determined by chronological sequencing and the 1st date of the potential claim.

Use the identification number for each potential claim on the:

1. Initial Potential Claim Record
2. Supplemental Potential Claim Record
3. Full and Final Potential Claim Record

Failure to comply with this procedure is:

1. Waiver of the potential claim and a waiver of the right to a corresponding claim for the disputed work in the administrative claim procedure
2. Bar to arbitration (Pub Cont Code § 10240.2)

#### **5-1.146B Initial Potential Claim Record**

Submit an Initial Potential Claim Record within 5 days of the Engineer's response to the RFI or within 5 days from the date when a dispute arises due to an act or failure to act by the Engineer. The Initial Potential Claim Record establishes the claim nature and circumstances. The claim nature and circumstances must remain consistent.

The Engineer responds within 5 days of the date of the Initial Potential Claim Record. Proceed with the potentially claimed work unless ordered.

Within 20 days of a request, provide access to the project records determined necessary by the Engineer to evaluate the potential claim.

#### **5-1.146C Supplemental Potential Claim Record**

Within 15 days of submitting the Initial Potential Claim Record, submit a Supplemental Potential Claim Record including:

1. Complete nature and circumstances causing the potential claim or event
2. Contract specifications supporting the basis of a claim
3. Estimated claim cost and an itemized breakdown of individual costs stating how the estimate was determined
4. TIA

The Engineer evaluates the Supplemental Potential Claim Record and furnishes you a response within 20 days of submittal. If the estimated cost or effect on the scheduled completion date changes, update the Supplemental Potential Claim Record information as soon as the change is recognized and submit this information.

#### **5-1.146D Full and Final Potential Claim Record**

Notify the Engineer within 10 days of the completion date of the potentially claimed work. The Engineer approves this completion date or notifies you of a revised date.

Within 30 days of the completion of the potentially claimed work, submit a Full and Final Potential Claim Record including:

1. A detailed factual account of the events causing the potential claim, including:
  - 1.1. Necessary dates
  - 1.2. Locations
  - 1.3. Work items affected by the potential claim
2. The Contract documents supporting the potential claim and a statement of the reasons these parts support entitlement
3. If a payment adjustment is requested, an itemized cost breakdown. Segregate costs into the following categories:
  - 3.1. Labor, including:
    - 3.1.1. Individuals
    - 3.1.2. Classifications
    - 3.1.3. Regular and overtime hours worked
    - 3.1.4. Dates worked
  - 3.2. Materials, including:
    - 3.2.1. Invoices
    - 3.2.2. Purchase orders
    - 3.2.3. Location of materials either stored or incorporated into the work
    - 3.2.4. Dates materials were transported to the job site or incorporated into the work
  - 3.3. Equipment, including:
    - 3.3.1. Detailed descriptions, including make, model, and serial number
    - 3.3.2. Hours of use
    - 3.3.3. Dates of use
    - 3.3.4. Equipment rates at the rental rate listed in Labor Surcharge and Equipment Rental Rates in effect when the affected work related to the claim was performed
4. If a time adjustment is requested:
  - 4.1. Dates for the requested time.
  - 4.2. Reasons for a time adjustment.
  - 4.3. Contract documentation supporting the requested time adjustment.
  - 4.4. TIA. The TIA must demonstrate entitlement to a time adjustment.
5. Identification and copies of your documents and copies of communications supporting the potential claim, including certified payrolls, bills, cancelled checks, job cost reports, payment records, and rental agreements
6. Relevant information, references, and arguments that support the potential claim

The Department does not consider a Full and Final Potential Claim Record that does not have the same nature, circumstances, and basis of claim as those specified on the Initial Potential Claim Record and Supplemental Potential Claim Record.

The Engineer evaluates the information presented in the Full and Final Potential Claim Record and furnishes you a response within 30 days of its receipt unless the Full and Final Potential Claim Record is submitted after Contract acceptance; in which case, a response may not be furnished. The Engineer's receipt of the Full and Final Potential Claim Record must be evidenced by postal return receipt or the Engineer's written receipt if delivered by hand.

#### **5-1.146E Dispute Resolution**

Comply with Section 5-1.15, "Dispute Resolution."

**Add:**

## **5-1.15 DISPUTE RESOLUTION**

### **5-1.15A General**

Section 5-1.15, "Dispute Resolution," applies to a contract with 100 or more working days.

The dispute resolution process is not a substitute for the submitting an RFI or a potential claim record.

### **5-1.15B Dispute Resolution Advisor**

Section 5-1.15B, "Dispute Resolution Advisor," applies to a contract with a total bid from \$3 million to \$10 million.

A dispute resolution advisor, hereinafter referred to as "DRA," is chosen by the Department and the Contractor to assist in the resolution of disputes.

The DRA shall be established by the Department and the Contractor within 30 days of contract approval.

The Department and the Contractor shall each propose 3 potential DRA candidates. Each potential candidate shall provide the Department and the Contractor with their disclosure statement. The disclosure statement shall include a resume of the potential candidate's experience and a declaration statement describing past, present, anticipated, and planned relationships with all parties involved in this contract.

The Department and the Contractor shall select one of the 6 nominees to be the DRA. If the Department and the Contractor cannot agree on one candidate, the Department and the Contractor shall each choose one of the 3 nominated by the other. The final selection of the DRA will be decided by a coin toss between the two candidates.

The Department and the Contractor shall complete and adhere to the Dispute Resolution Advisor Agreement. No DRA meeting shall take place until the Dispute Resolution Advisor Agreement has been signed by all parties, unless all parties agree to sign it at the first meeting.

If DRA needs outside technical services, technical services shall be preapproved by both the Department and the Contractor.

DRA recommendations are nonbinding.

The Contractor shall not use the DRA for disputes between subcontractors or suppliers that have no grounds for a lawsuit against the Department.

DRA replacement is selected in the same manner as the original selection. The appointment of a replacement DRA will begin promptly upon determination of the need for replacement. The Dispute Resolution Advisor Agreement shall be amended to reflect the change of the DRA.

Failure of the Contractor to participate in selecting DRA will result in the withhold of 25 percent of the estimated value of all work performed during each estimate period that the Contractor fails to comply. DRA withholds will be released for payment on the next monthly progress payment following the date that the Contractor has provided assistance in choosing the DRA and no interest will be due the Contractor.

The State and the Contractor shall bear the costs and expenses of the DRA equally.

The DRA shall be compensated at an agreed rate of \$1,500 per day for time spent per meeting either at the start of the project or for a dispute. A member serving on more than one State DRA or Dispute Resolution Board, regardless the number of meetings per day shall not be paid more than the agreed rate per day. The agreed rate shall be considered full compensation for on-site time, travel expenses, transportation, lodging, time for travel, and incidentals for each day or portion thereof that the DRA is at an authorized DRA meeting.

No additional compensation will be made for time spent by the DRA to review and research activities outside the official DRA meetings unless that time, such as time spent evaluating and preparing recommendations on specific issues presented to the DRA, has been specifically agreed to in advance by the State and Contractor. Time away from the project that has been specifically agreed to in advance by the Department and the Contractor will be compensated at an agreed rate of \$150 per hour. The agreed amount of \$150 per hour shall include all incidentals including expenses for telephone, fax, and computer services.

The State will provide conference facilities for DRA meetings at no cost to the Contractor.

The Contractor shall make direct payments to the DRA for participation in authorized meetings and approved hourly rate charges from invoices submitted.

The State will reimburse the Contractor for the State's share of the costs.

There will be no markups applied to expenses associated with the DRA, either by the DRA or by the Contractor when requesting payment of the State's share of DRA expenses. Regardless of the DRA recommendation, neither party will be entitled to reimbursement of DRA costs from the other party.

The Contractor shall submit extra work bills and include invoices with original supporting documents for reimbursement of the State's share.

The cost of technical services will be borne equally by the State and Contractor. There will be no markups for these costs.

A copy of the "Dispute Resolution Advisor Agreement" to be executed by the Contractor, State and the DRA is as follows:

**DISPUTE RESOLUTION ADVISOR AGREEMENT**

\_\_\_\_\_  
(Contract Identification)

Contract No. \_\_\_\_\_

**THIS DISPUTE RESOLUTION ADVISOR AGREEMENT, hereinafter called "AGREEMENT"**, made and entered into this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_, between the State of California, acting through the California Department of Transportation and the Director of Transportation, hereinafter called the "STATE," \_\_\_\_\_ hereinafter called the "CONTRACTOR," and \_\_\_\_\_, the Dispute Resolution Advisor, hereinafter called the "DRA."

WITNESSETH, that

WHEREAS, the STATE and the CONTRACTOR, hereinafter called the "parties," are now engaged in the construction on the State Highway project referenced above; and

WHEREAS, the Standard Specifications for the above referenced contract provides for the establishment and operation of the DRA to assist in resolving disputes; and

WHEREAS, the DRA is composed of one person, chosen by the CONTRACTOR and the STATE;

NOW THEREFORE, in consideration of the terms, conditions, covenants, and performance contained herein, or attached and incorporated and made a part hereof, the STATE, the CONTRACTOR, and the DRA hereto agree as follows:

**SECTION I DESCRIPTION OF WORK**

To assist in the timely resolution of disputes between the parties, the contract provides for the establishment and the operation of the DRA. The DRA is to fairly and impartially consider disputes placed before it and provide recommendations for resolution of these disputes to the parties. The DRA shall provide recommendations based on the facts related to the dispute, the contract and applicable laws and regulations. The DRA shall perform the services necessary to participate in the DRA's actions as designated in Section III, Scope of Work.

**SECTION II DRA QUALIFICATIONS**

The DRA shall be knowledgeable in the type of construction and contract documents anticipated by the contract and shall have completed training through the Dispute Review Board Foundation. In addition, it is desirable for the DRA to have served on several State Dispute Resolution Boards (DRB).

No DRA shall have prior direct involvement in this contract. No DRA shall have a financial interest in this contract or parties thereto, including but not limited to the CONTRACTOR, subcontractors, suppliers, consultants, and legal and business services, within a period 6 months prior to award and during this contract. Exceptions to above are compensation for services on this or other DRAs and DRBs or retirement payments or pensions received from a party that are not tied to, dependent on or affected by the net worth of the party.

The DRA shall fully disclose all direct or indirect professional or personal relationships with all key members of the contract.

**SECTION III SCOPE OF WORK**

The Scope of Work of the DRA includes, but is not limited to, the following:

**A. PROCEDURES**

The DRA shall meet with the parties at the start of the project to establish procedures that will govern the conduct of its business and reporting procedures in conformance with the requirements of the contract and the terms of this AGREEMENT. The DRA established procedures shall only be implemented upon approval by the parties. Subsequent meetings shall be held only to hear disputes between the parties.

The DRA shall not meet with, or discuss contract issues with individual parties.

The State shall provide the DRA with the contract and all written correspondence regarding the dispute between the parties and, if available, the Contractor's supplemental potential claim record, and the Engineer's response to the supplemental potential claim record.

The parties shall not call the DRA who served on this contract as a witness in arbitration proceedings, which may arise from this contract.

The DRA shall have no claim against the STATE or the CONTRACTOR, or both, from claimed harm arising out of the parties' evaluations of the DRA's opinions.

## **B. DISPUTE MEETING**

The term "dispute meeting" as used in this subsection shall refer to both the informal and traditional dispute meeting processes, unless otherwise noted.

If the CONTRACTOR requests a dispute meeting with the DRA, the Contractor must simultaneously notify the STATE. Upon being notified of the need for a dispute meeting, the DRA shall review and consider the dispute. The DRA shall determine the time and location of the dispute meeting with due consideration for the needs and preferences of the parties, while recognizing the importance of a speedy resolution to the dispute.

Dispute meetings shall be conducted at any location that would be convenient and provide required facilities and access to necessary documentation.

Only the STATE's Area Construction Engineer, Resident Engineer, and Structure Representative and the CONTRACTOR's or subcontractor's, Superintendent or Project Manager may present information at a dispute meeting. There shall be no participation of persons who are not directly involved in the contract or who do not have direct knowledge of the dispute. The exception to this is technical services, as described below:

The DRA, with approval of the parties, may obtain technical services necessary to adequately review the disputes presented, including audit, geotechnical, schedule analysis and other services. The parties' technical staff may supply those services as appropriate. The cost of technical services, as agreed to by the parties, shall be borne equally by the two parties as specified in an approved contract change order. The CONTRACTOR shall not be entitled to markups for the payments made for these services.

At the dispute meeting the DRA may ask questions, seek clarification, and request further clarification of data presented by either of the parties as may be necessary to assist in making a fully informed recommendation. However, the DRA shall refrain from expressing opinions on the merits of statements on matters under dispute during the parties' presentations. Each party will be given ample time to fully present its position, make rebuttals, provide relevant documents, and respond to DRA questions and requests.

There shall be no testimony under oath or cross-examination, during DRA dispute meetings. There shall be no reporting of the procedures by a shorthand reporter or by electronic means. Documents and verbal statements shall be received by the DRA in conformance with the rules and regulations established at the first meeting between the DRA and parties. These established rules and regulations need not comply with prescribed legal laws of evidence.

Failure to attend a dispute meeting by either of the parties shall be conclusively considered by the DRA as indication that the non-attending party considers all written documents and correspondence submitted as their entire and complete argument. The claimant shall discuss the dispute, followed by the other party. Each party shall then be allowed one or more rebuttals at the meeting until all aspects of the dispute are thoroughly covered.

### **1. TRADITIONAL DISPUTE MEETING:**

The following procedure shall be used for the traditional dispute meeting:

- a. Within 5 days after receiving the STATE's written response to the CONTRACTOR's supplemental potential claim record, the CONTRACTOR shall refer the dispute to the DRA, if the CONTRACTOR wishes to further pursue the dispute. The CONTRACTOR shall make the referral in writing to the DRA, simultaneously copied to the STATE. The written dispute referral shall describe the disputed matter in individual discrete segments, so that it will be clear to both parties and the DRA what discrete elements of the dispute have been resolved, and which remain unresolved, and shall include an estimate of the cost of the affected work and impacts, if any, on project completion.
- b. The parties shall each be afforded an opportunity to be present and to be heard by the DRA, and to offer evidence. Either party furnishing written evidence or documentation to the DRA must furnish copies of such information to the other party a minimum of 10 days prior to the date the DRA is scheduled to convene the meeting for the dispute. Either party shall produce such additional evidence as the DRA may deem necessary to reach an understanding and a determination of the dispute. The party furnishing additional evidence shall furnish copies of such additional evidence to the other party at the same time the evidence is provided to the DRA. The DRA shall not consider evidence not furnished in conformance with the terms specified herein.

- c. Upon receipt by the DRA of a written referral of a dispute, the DRA shall convene to review and consider the dispute. The dispute meeting shall be held no later than 25 days after receipt of the written referral unless otherwise agreed to by all parties.
- d. The DRA shall furnish a written report to both parties. The DRA may request clarifying information of either party within 5 days after the DRA dispute meeting. Requested information shall be submitted to the DRA within 5 days of the DRA request. The DRA shall complete its report and submit it to the parties within 10 days of the DRA dispute meeting, except that time extensions may be granted at the request of the DRA with the written concurrence of both parties. The report shall summarize the facts considered, the contract language, law or regulation viewed by the DRA as pertinent to the dispute, and the DRA's interpretation and philosophy in arriving at its conclusions and recommendations and, if appropriate, recommends guidelines for determining compensation. The DRA's written opinion shall stand on its own, without attachments or appendices.
- e. Within 10 days after receiving the DRA's report, both parties shall respond to the DRA in writing signifying that the dispute is either resolved or remains unresolved. Failure to provide the written response within the time specified, or a written rejection of the DRA's recommendation or response to a request for reconsideration presented in the report by either party, shall conclusively indicate that the party(s) failing to respond accepts the DRA recommendation. Immediately after responses have been received from both parties, the DRA shall provide copies of both responses to the parties simultaneously. Either party may request clarification of elements of the DRA's report from the DRA prior to responding to the report. The DRA shall consider any clarification request only if submitted within 5 days of receipt of the DRA's report, and if submitted simultaneously in writing to both the DRA and the other party. Each party may submit only one request for clarification for any individual DRA report. The DRA shall respond, in writing, to requests for clarification within 5 days of receipt of such requests.
- f. Either party may seek a reconsideration of the DRA's recommendation. The DRA shall only grant reconsideration based upon submission of new evidence and if the request is submitted within the 10 day time limit specified for response to the DRA's written report. Each party may submit only one request for reconsideration regarding an individual DRA recommendation.
- g. If the parties are able to settle their dispute with the aid of the DRA's report, the STATE and CONTRACTOR shall promptly accept and implement the settlement of the parties. If the parties cannot agree on compensation within 30 days of the acceptance by both parties of the settlement, either party may request the DRA to make a recommendation regarding compensation.

## **2. INFORMAL DISPUTE MEETING**

An informal dispute meeting shall be convened, only if, the parties and the DRA agree that this dispute resolution process is appropriate to settle the dispute.

The following procedure shall be used for the informal dispute meeting:

- a. The parties shall furnish the DRA with one copy of pertinent documents requested by the DRA that are or may become necessary for the DRA to perform its function. The party furnishing documents shall furnish such documents to the other party at the same time the document is provided to the DRA.
- b. After the dispute meeting has concluded, the DRA shall deliberate in private the same day, until a response to the parties is reached or as otherwise agreed to by the parties.
- c. The DRA then verbally delivers its recommendation with findings to the parties.
- d. After the recommendation is presented, the parties may ask for clarifications.
- e. Occasionally the DRA, on complex issues, may be unable to formulate a recommendation based on the information given at a dispute meeting. However, the DRA may provide the parties with advice on strengths and weaknesses of their prospective positions, in the hope of the parties reaching settlement.
- f. If the parties are able to settle their dispute with the aid of the DRA's opinion, the STATE and CONTRACTOR shall promptly accept and implement the settlement of the parties.
- g. The DRA will not be bound by its oral recommendation in the event that a dispute is later heard by the DRA in a traditional dispute meeting.

Unless the dispute is settled, use of the informal dispute meeting does not relieve the parties of their responsibilities under Section 5-1.15B, "Dispute Resolution Advisor," of the Standard Specifications or Subsection, "Traditional Dispute Meeting," of this AGREEMENT. There will be no extension of time allowed for the process to permit the use of the informal dispute meeting, unless otherwise agreed to by the parties.

## **SECTION IV TIME FOR BEGINNING AND COMPLETION**

Once established, the DRA shall be in operation until the day the Director accepts the contract. The DRA shall not begin work under the terms of this AGREEMENT until authorized in writing by the STATE or as agreed to by the parties.

## **SECTION V PAYMENT**

The DRA shall be compensated at an agreed rate of \$1,500 per day for time spent per meeting, either at the start of the project or for a dispute. A member serving on more than one State DRA or DRB, regardless the number of meetings per day, shall not be paid more than the agreed rate per day. The agreed rate shall be considered full compensation for onsite time, travel expenses, transportation, lodging, time for travel and incidentals for each day, or portion thereof that the DRA is at an authorized DRA meeting. No additional compensation will be made for time spent by the DRA to review and research activities outside the official DRA meetings unless that time, (such as time spent evaluating and preparing recommendations on specific issues presented to the DRA), has been specifically agreed to in advance by the parties. Time away from the project, which has been specifically agreed to in advance by the parties, will be compensated at an agreed rate of \$150 per hour. The agreed amount of \$150 per hour shall include all incidentals including expenses for telephone, fax, and computer services. The State will provide administrative services such as conference facilities to the DRA.

### **A. PAYMENT PROCESSING**

The CONTRACTOR shall make direct payments to the DRA for their participation in authorized meetings and approved hourly rate charges, from invoices submitted by the DRA, and technical services.

The DRA may submit invoices to the CONTRACTOR for partial payment for work performed and services rendered for their participation in authorized meetings not more often than once per month during the progress of the work. The invoices shall be in a format approved by the parties and accompanied by a general description of activities performed during that billing period. Payment for hourly fees, at the agreed rate, shall not be paid to the DRA until the amount and extent of those fees are approved by the STATE and CONTRACTOR.

### **B. INSPECTION OF COSTS RECORDS**

The DRA and the CONTRACTOR shall keep available for inspection by representatives of the STATE and the United States, for a period of 3 years after final payment, the cost records and accounts pertaining to this AGREEMENT. If any litigation, claim, or audit arising out of, in connection with, or related to this contract is initiated before the expiration of the 3-year period, the cost records and accounts shall be retained until such litigation, claim, or audit involving the records is completed.

## **SECTION VI ASSIGNMENT OF TASKS OF WORK**

The DRA shall not assign the work of this AGREEMENT.

## **SECTION VII TERMINATION OF DRA**

The DRA may resign after providing not less than 15 days written notice of the resignation to the STATE and CONTRACTOR. The DRA may be terminated, by either party, for failing to fully comply at all times with all required employment or financial disclosure conditions of DRA membership in conformance with the terms of the contract and this AGREEMENT. Each party shall document the need for replacement and substantiate the replacement request in writing to the other party and the DRA.

## **SECTION VIII LEGAL RELATIONS**

The parties hereto mutually understand and agree that the DRA in the performance of duties is acting in the capacity of an independent agent and not as an employee of either party.

No party to this AGREEMENT shall bear a greater responsibility for damages or personal injury than is normally provided by Federal or State of California Law.

Notwithstanding the provisions of this contract that require the CONTRACTOR to indemnify and hold harmless the STATE, the parties shall jointly indemnify and hold harmless the DRA from and against all claims, damages, losses, and expenses, including but not limited to attorney's fees, arising out of and resulting from the findings and recommendations of the DRA.

## **SECTION IX CONFIDENTIALITY**

The parties hereto mutually understand and agree that all documents and records provided by the parties in reference to issues brought before the DRA, which documents and records are marked "Confidential - for use by the DRA only," shall be kept in confidence and used only for the purpose of resolution of subject disputes, and for assisting in development of DRA findings and recommendations; that such documents and records will not be utilized or revealed to others, except to officials of the parties who are authorized to act on the subject disputes, for any purposes, during the life of this AGREEMENT. Upon termination of this AGREEMENT, said confidential documents and records, and all copies thereof, shall be returned to the parties who furnished them to the DRA. However, the parties understand that such documents may be subsequently

discoverable and admissible in court or arbitration proceedings unless a protective order has been obtained by the party seeking further confidentiality.

**SECTION X DISPUTES**

Disputes between the parties arising out of the work or other terms of this AGREEMENT that cannot be resolved by negotiation and mutual concurrence between the parties or through the administrative process provided in the contract shall be resolved by arbitration as provided in Section 9-1.10, "Arbitration," of the Standard Specifications. Disputes between the DRA and the parties that cannot be resolved by negotiation and mutual concurrence shall be resolved in the appropriate forum.

**SECTION XI VENUE, APPLICABLE LAW, AND PERSONAL JURISDICTION**

In the event that any party, including the DRA, deems it necessary to institute arbitration proceedings to enforce any right or obligation under this AGREEMENT, the parties hereto agree that such action shall be initiated in the Office of Administrative Hearings of the State of California. The parties hereto agree that all questions shall be resolved by arbitration by application of California law and that the parties to such arbitration shall have the right of appeal from such decisions to the Superior Court in conformance with the laws of the State of California. Venue for the arbitration shall be Sacramento or any other location as agreed to by the parties.

**SECTION XII FEDERAL REVIEW AND REQUIREMENTS**

On Federal-Aid contracts, the Federal Highway Administration shall have the right to review the work of the DRA in progress, except for private meetings or deliberations of the DRA.

Other Federal requirements in this agreement shall only apply to Federal-Aid contracts.

**SECTION XIII CERTIFICATION OF CONTRACTOR, DRA, AND STATE**

IN WITNESS WHEREOF, the parties hereto have executed this AGREEMENT as of the day and year first above written.

DRA

By: \_\_\_\_\_

Title: \_\_\_\_\_

CONTRACTOR

CALIFORNIA DEPARTMENT  
OF TRANSPORTATION

By: \_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

### **5-1.15C Dispute Resolution Board**

Section 5-1.15C, "Dispute Resolution Board," applies to a contract with a total bid of over \$10 million.

The Dispute Resolution Board, hereinafter referred to as "DRB," is a three member board established by the Department and Contractor to assist in the resolution of disputes.

The DRB shall be established by the Department and the Contractor within 45 days after contract approval.

The DRB shall consist of one member selected by the Department and approved by the Contractor, one member selected by the Contractor and approved by the Department, and a third member selected by the first 2 members and approved by both the Department and the Contractor.

The Department and Contractor shall provide the other written notification for approval of the name of their DRB nominee along with the nominee's disclosure statement.

Disclosure statements shall include a resume of the nominee's experience and a declaration statement describing past, present, anticipated, and planned relationships with all parties involved in this contract. Objections to nominees shall be based on a specific breach or violation of nominee responsibilities or on nominee qualifications. The Department or the Contractor may, on a one-time basis, object to the other's nominee without specifying a reason and this person shall not be selected for the DRB. Another person shall then be nominated within 15 days.

The 2 DRB members shall proceed with the selection of the third DRB member immediately after receiving written notification from the Department of their selection. The 2 DRB members shall provide their recommendation simultaneously to the parties within 15 days. The third member shall provide disclosure statement to the first 2 DRB members, to the Department, and the Contractor. The professional experience of the third DRB member shall complement that of the first 2 DRB members. The third DRB member shall be subject to mutual approval of the Department and the Contractor. If the 2 DRB members cannot agree on the third nominee, they shall submit a list of nominees to the Department and the Contractor for final selection and approval.

If the Department and the Contractor cannot agree on the third DRB member, or if the first 2 DRB members are unable to agree upon a recommendation, the Department and the Contractor shall select 6 names from the current list of arbitrators certified by the Public Works Contract Arbitration Committee created by Article 7.2 of the State Contract Act. The 2 DRB members shall then select one of the 6 names by a blind draw.

The 3 DRB members shall appoint one member as a chairperson to provide leadership for the DRB's activities. The chairperson shall be approved by the Department and the Contractor. In the event of an impasse, the third DRB member shall become the chairperson.

The Department and Contractor shall complete and adhere to the Dispute Resolution Board Agreement. No DRB meeting shall take place until the Dispute Resolution Board Agreement has been signed by all parties, unless all parties agree to sign it at the first meeting.

If the DRB needs outside technical services, technical services shall be preapproved by both the Department and the Contractor.

DRB recommendations are nonbinding.

The Contractor shall not use the DRB for disputes between the subcontractors or suppliers that have no grounds for a lawsuit against the Department.

DRB member replacements are selected in the same manner as the original selection. The appointment of a replacement DRB member will begin promptly upon determination of the need for replacement. The Dispute Resolution Board Agreement shall be amended to reflect the change in the DRB.

Failure of the Contractor to participate in establishing the DRB will result in the withholding of 25 percent of the estimated value of all work performed during each estimate period that the Contractor fails to comply. DRB withholds will be released for payment on the next monthly progress payment following the date that the Contractor has provided assistance in establishing the DRB and no interest will be due the Contractor.

The Department and the Contractor shall bear the costs and expenses of the DRB equally.

Each DRB member shall be compensated at an agreed rate of \$1,500 per day for time spent per meeting either at the start of the project, for scheduled progress, or dispute meetings. A member serving on more than one Department DRB or Dispute Resolution Advisor (DRA), regardless of the number of meetings per day shall not be paid more than the agreed rate per day. The agreed rate shall be considered full compensation for on-site time, travel expenses, transportation, lodging, time for travel, and incidentals for each day or portion thereof that the DRB member is at an authorized DRB meeting.

No additional compensation will be made for time spent by DRB members in review and research activities outside the official DRB meetings unless that time, such as time spent evaluating and preparing recommendations on specific issues presented to the DRB, has been specifically agreed to in advance by the Department and Contractor. Time away from the project, which has been specifically agreed to in advance by the Department and Contractor, will be compensated at an agreed rate of \$150 per hour. The agreed amount of \$150 per hour shall include all incidentals including expenses for telephone, fax, and computer services.

The Department will provide conference facilities for DRB meetings at no cost to the Contractor.

The Contractor shall make direct payments to each DRB member for their participation in authorized meetings and approved hourly rate charges from invoices submitted by each DRB member.

The Department will reimburse the Contractor for the Department's share of the costs.

There will be no markups applied to expenses connected with the DRB, either by the DRB members or by the Contractor when requesting payment of the Department's share of DRB expenses. Regardless of the DRB recommendation, neither party shall be entitled to reimbursement of DRB costs from the other party.

The Contractor shall submit extra work bills and include evidence of every payment to each DRB member in the form of a cancelled check or bank statement within 30 days of payment.

The cost of technical services requested by the DRB will be borne equally by the State and Contractor. There will be no markups for these costs.

A copy of the "Dispute Resolution Board Agreement" to be executed by the Department, Contractor, and the 3 DRB members after approval of the contract follows:

**DISPUTE RESOLUTION BOARD AGREEMENT**

\_\_\_\_\_  
(Contract Identification)

Contract No. \_\_\_\_\_

**THIS DISPUTE RESOLUTION BOARD AGREEMENT, hereinafter called "AGREEMENT",** made and entered into this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_, between the State of California, acting through the California Department of Transportation and the Director of Transportation, hereinafter called the "STATE," \_\_\_\_\_ hereinafter called the "CONTRACTOR," and the Dispute Resolution Board, hereinafter called the "DRB" consisting of the following members:

\_\_\_\_\_  
(DRB Member) ,

\_\_\_\_\_  
(DRB Member) ,

and \_\_\_\_\_  
(DRB Chairperson)

WITNESSETH, that

WHEREAS, the STATE and the CONTRACTOR, hereinafter called the "parties," are now engaged in the construction on the State Highway project referenced above; and

WHEREAS, the Standard Specifications for the above referenced contract provides for the establishment and operation of the DRB to assist in resolving disputes; and

WHEREAS, the DRB is composed of three members, one selected by the STATE, one selected by the CONTRACTOR, and the third member selected by the other two members and approved by the parties; and

NOW THEREFORE, in consideration of the terms, conditions, covenants, and performance contained herein, or attached and incorporated and made a part hereof, the STATE, the CONTRACTOR, and the DRB members hereto agree as follows:

**SECTION I DESCRIPTION OF WORK**

To assist in the timely resolution of disputes between the parties, the contract provides for the establishment and the operation of the DRB. The DRB is to fairly and impartially consider disputes placed before it and provide recommendations for resolution of these disputes to the parties. The DRB shall provide recommendations based on the facts related to the dispute, the contract and applicable laws and regulations. The DRB shall perform the services necessary to participate in the DRB's actions as designated in Section III, Scope of Work.

**SECTION II DRB QUALIFICATIONS**

DRB members shall be knowledgeable in the type of construction and contract documents anticipated by the contract and shall have completed training through the Dispute Review Board Foundation.

No DRB member shall have prior direct involvement in this contract. No DRB member shall have a financial interest in this contract or parties thereto, including but not limited to the CONTRACTOR, subcontractors, suppliers, consultants, and legal and business services, within a period 6 months prior to award and during this contract. Exceptions to above are compensation for services on this or other DRBs and DRAs or retirement payments or pensions received from a party that are not tied to, dependent on or affected by the net worth of the party.

DRB members shall fully disclose all direct or indirect professional or personal relationships with all key members of the contract.

**SECTION III SCOPE OF WORK**

The scope of work of the DRB includes, but is not limited to, the following:

## **A. PROCEDURES**

The DRB shall establish procedures that will govern the conduct of its business and reporting procedures in conformance with the requirements of the contract and the terms of this AGREEMENT. The DRB established procedures shall only be implemented upon approval of the parties.

The DRB Chairperson shall schedule progress and dispute meetings and any other DRB activities.

The parties shall not call on any of the DRB members, who served on this contract, as a witness in arbitration proceedings, which may arise from this contract.

DRB members shall have no claim against the STATE or the CONTRACTOR, or both, from claimed harm arising out of the parties' evaluations of the DRB's opinions.

During progress or dispute meetings, DRB members shall refrain from expressing opinions on the merits of statements on matters under dispute or potential dispute. Opinions of DRB members expressed in private sessions shall be kept strictly confidential. Individual DRB members shall not meet with, or discuss contract issues with individual parties. Discussions regarding the project between the DRB members and the parties shall be in the presence of all three members and both parties. Individual DRB members shall not undertake independent investigations of any kind pertaining to disputes or potential disputes, except with the knowledge of both parties and as expressly directed by the DRB Chairperson.

## **B. PROGRESS MEETINGS**

DRB members shall visit the project site and meet with representatives of the parties to keep abreast of construction activities and to develop familiarity with the work in progress. Scheduled progress meetings shall be held at or near the project site. The DRB shall meet at least once at the start of the project, and at least once every 4 months thereafter. The frequency, exact time, and duration of additional site visits and progress meetings shall be as recommended by the DRB and approved by the parties consistent with the construction activities or matters under consideration and dispute. Scheduled progress meetings may be waived, if the parties are in agreement, when the only work remaining is plant establishment work. Each meeting shall consist of a round table discussion and a field inspection of the work being performed on the contract, if necessary. Each meeting shall be attended by representatives of both parties. The agenda shall generally be as follows:

1. Meeting opened by the DRB Chairperson.
2. Remarks by the STATE's representative.
3. A description by the CONTRACTOR's representative of work accomplished since the last meeting; the current schedule status of the work; and a forecast for the coming period.
4. An outline by the STATE's representative of the status of the work as the STATE views it.
5. An outline by the CONTRACTOR's representative of potential problems and a description of proposed solutions.
6. A brief description by the CONTRACTOR's and the STATE's representative of potential claims and disputes that have surfaced since the last meeting.
7. A summary by the STATE's representative, the CONTRACTOR's representative, or the DRB of the status of past potential claims and disputes.

The STATE's representative will prepare minutes of all progress meetings and circulate them for revision and approval by all concerned within 10 days of the meeting.

## **C. DISPUTE MEETING**

The term "dispute meeting" as used in this subsection shall refer to both the informal and traditional dispute meeting processes, unless otherwise noted.

Either the STATE or the CONTRACTOR may request a dispute meeting with the DRB. The requesting party shall simultaneously notify the other party of each dispute meeting request. Upon being notified of the need for a dispute meeting, the DRB shall review and consider the dispute. The DRB shall determine the time and location of the dispute meeting with due consideration for the needs and preferences of the parties, while recognizing the importance of a speedy resolution to the dispute.

Dispute meetings shall be conducted at any location that would be convenient and provide required facilities and access to necessary documentation.

No DRB dispute meeting shall take place later than 30 days prior to acceptance of the contract.

Only the STATE's Area Construction Engineer, Resident Engineer, and Structure Representative and the CONTRACTOR's or subcontractor's, Superintendent or Project Manager may present information at a dispute meeting. There shall be no participation of persons who are not directly involved in the contract or who do not have direct knowledge of the dispute. The exception to this is technical services, as described below:

The DRB, with approval of the parties, may obtain technical services necessary to adequately review the disputes presented, including audit, geotechnical, schedule analysis and other services. The parties' technical staff may supply those services as appropriate. The cost of technical services, as agreed to by the parties, shall be borne equally by the two parties as specified in an approved contract change order. The CONTRACTOR shall not be entitled to markups for the payments made for these services.

At the dispute meeting the DRB may ask questions, seek clarification, and request further clarification of data presented by either of the parties as may be necessary to assist in making a fully informed recommendation. However, the DRB shall refrain from expressing opinions on the merits of statements on matters under dispute during the parties' presentations. The claimant shall discuss the dispute, followed by the other party. Each party shall then be allowed one or more rebuttals at the meeting until all aspects of the dispute are thoroughly covered. Each party will be given ample time to fully present its position, make rebuttals, provide relevant documents, and respond to DRB questions and requests.

There shall be no testimony under oath or cross-examination, during DRB dispute meetings. There shall be no reporting of the procedures by a shorthand reporter or by electronic means. Documents and verbal statements shall be received by the DRB in conformance with the procedures established at the first meeting between the DRB and the parties. These established procedures need not comply with prescribed legal laws of evidence.

Failure to attend a dispute meeting by either of the parties shall be conclusively considered by the DRB as indication that the non-attending party considers all written documents and correspondence submitted as their entire and complete argument.

After dispute meetings are concluded, the DRB shall meet in private and reach a conclusion supported by two or more members. Private sessions of the DRB may be held at a location other than the job site or by electronic conferencing as deemed appropriate, in order to expedite the process.

The DRB shall make every effort to reach a unanimous decision.

#### **1. TRADITIONAL DISPUTE MEETING:**

The following procedure shall be used for the traditional dispute meeting:

- a. Within 21 days after receiving the STATE's written response to the CONTRACTOR's supplemental potential claim record, the CONTRACTOR shall refer the dispute to the DRB if the CONTRACTOR wishes to further pursue the dispute. The CONTRACTOR shall make the referral in writing to the DRB, simultaneously copied to the STATE. The written dispute referral shall describe the disputed matter in individual discrete segments, so that it will be clear to both parties and the DRB what discrete elements of the dispute have been resolved, and which remain unresolved, and shall include an estimate of the cost of the affected work and impacts, if any, on project completion.
- b. The parties shall each be afforded an opportunity to be present and to be heard by the DRB, and to offer evidence. Either party furnishing written evidence or documentation to the DRB must furnish copies of such information to the other party a minimum of 15 days prior to the date the DRB is scheduled to convene the meeting for the dispute. Either party shall produce such additional evidence as the DRB may deem necessary to reach an understanding and a determination of the dispute. The party furnishing additional evidence shall furnish copies of such additional evidence to the other party at the same time the evidence is provided to the DRB. The DRB shall not consider evidence not furnished in conformance with the terms specified herein.
- c. Upon receipt by the DRB of a written referral of a dispute, the DRB shall convene to review and consider the dispute. The dispute meeting shall be held no earlier than 30 days and no later than 60 days after receipt of the written referral unless otherwise agreed to by all parties.
- d. The DRB may request clarifying information of either party within 10 days after the dispute meeting. Requested information shall be submitted to the DRB within 10 days of the DRB request.
- e. The DRB shall furnish a written report to the parties with its conclusion(s) and recommendation(s). The DRB shall complete its report, including minority opinion, if any, and submit it to the parties within 30 days of the dispute meeting, except that time extensions may be granted at the request of the DRB with the written concurrence of the parties. The report shall summarize the facts considered, the contract language, law or regulation viewed by the DRB as pertinent to the dispute, and the DRB's interpretation and reasoning in arriving at its conclusion(s) and recommendation(s) and, if appropriate, recommends guidelines for determining compensation. The DRB's written opinion shall stand on its own, without attachments or appendices. The DRB Chairperson shall furnish a copy of the written recommendation report to the DRB Coordinator, Division of Construction, MS 44, P.O. Box 942874, Sacramento, CA 94274.
- f. Within 30 days after receiving the DRB's report, the parties shall respond to the DRB in writing signifying that the dispute is either resolved or remains unresolved. Failure to provide the written response within the time specified, or a written rejection of the DRB's recommendation or a written response requesting the DRB reconsider their recommendation, shall conclusively indicate that the party(s) failing to respond accepts the DRB recommendation. Immediately after responses have been received from both parties, the DRB shall provide copies of both responses to the parties simultaneously. Either party may request clarification of elements of the DRB's report from the DRB

prior to responding to the report. The DRB shall consider any clarification request only if submitted within 10 days of receipt of the DRB's report, and if submitted simultaneously in writing to both the DRB and the other party. Each party may submit only one request for clarification for any individual DRB report. The DRB shall respond, in writing, to requests for clarification within 10 days of receipt of such requests.

- g. Either party may seek a reconsideration of the DRB's recommendation. The DRB shall only grant reconsideration based upon submission of new evidence and if the request is submitted within the 30 day time limit specified for response to the DRB's written report. Each party may submit only one request for reconsideration regarding an individual DRB recommendation.
- h. If the parties are able to settle their dispute with the aid of the DRB's report, the STATE and the CONTRACTOR shall promptly accept and implement the settlement of the parties. If the parties cannot agree on compensation within 60 days of the acceptance by both parties of the settlement, either party may request the DRB to make a recommendation regarding compensation.

## **2. INFORMAL DISPUTE MEETING**

An informal dispute meeting shall be convened, only if, the parties and the DRB agree that this dispute resolution process is appropriate to settle the dispute.

The following procedure shall be used for the informal dispute meeting:

- a. The parties shall furnish the DRB with one copy of pertinent documents requested by the DRB that are or may become necessary for the DRB to perform its function. The party furnishing documents shall furnish such documents to the other party at the same time the document is provided to the DRB.
- b. After the dispute meeting has concluded, the DRB members shall deliberate in private the same day until a response to the parties is reached or as otherwise agreed to by the parties.
- c. The DRB then verbally delivers its recommendation with findings, including minority opinion, if any, to the parties.
- d. After the recommendation is presented, the parties may ask for clarifications.
- e. Occasionally the DRB may be unable to formulate a recommendation based on the information given at a dispute meeting. However, the DRB may provide the parties with advice on strengths and weaknesses of their prospective positions, in the hope of the parties reaching settlement.
- f. If the parties are able to settle their dispute with the aid of the DRB's opinion, the STATE and the CONTRACTOR shall promptly accept and implement the settlement of the parties.
- g. The DRB will not be bound by its verbal recommendation in the event that a dispute is later heard by the DRB in a traditional dispute meeting.

Unless the dispute is settled, use of the informal dispute meeting does not relieve the parties of their responsibilities under Section 5-1.15C, "Dispute Resolution Board," of the Standard Specifications or subsection, "Traditional Dispute Meeting," of this AGREEMENT. There will be no extension of time allowed for the process to permit the use of the informal dispute meeting, unless otherwise agreed to by the parties.

## **SECTION IV TIME FOR BEGINNING AND COMPLETION**

DRB members shall not begin work under the terms of this AGREEMENT, until authorized in writing by the STATE or as agreed to by the parties. Once established, the DRB shall be in operation until the Director accepts the contract. If the contract is terminated in accordance with Section 8-1.08, "Termination of Control," of the Standard Specifications, the DRB will be dissolved.

## **SECTION V PAYMENT**

Each DRB member shall be compensated at an agreed rate of \$1,500 per day for time spent per meeting, either at start of project, or a scheduled progress or a dispute meeting. A member serving on more than one State DRB or DRA, regardless of the number of meetings per day, shall not be paid more than the agreed rate per day. The agreed rate shall be considered full compensation for on site time, travel expenses, transportation, lodging, time for travel and incidentals for each day, or portion thereof that the DRB member is at an authorized DRB meeting. No additional compensation will be made for time spent by DRB member to review and research activities outside the official DRB meetings unless that time, such as time spent evaluating and preparing recommendations on specific issues presented to the DRB, has been specifically agreed to in advance by the parties. Time away from the project, which has been specifically agreed to in advance by the parties, will be compensated at an agreed rate of \$150 per hour. The agreed amount of \$150 per hour shall include all incidentals including expenses for telephone, fax, and computer services. The State will provide administrative services such as conference facilities to the DRB.

## **A. PAYMENT PROCESSING**

The CONTRACTOR shall make direct payments to each DRB member for their participation in authorized meetings and approved hourly rate charges, from invoices submitted by each DRB member, and technical services.

DRB members may submit invoices to the CONTRACTOR for partial payment for work performed and services rendered for their participation in authorized meetings not more often than once per month during the progress of the work. The invoices shall be in a format approved by the parties and accompanied by a general description of activities performed during that billing period. Payment for hourly fees, at the agreed rate, shall not be paid to a DRB member until the amount and extent of those fees are approved by the STATE and the CONTRACTOR.

## **B. INSPECTION OF COSTS RECORDS**

DRB members and the CONTRACTOR shall keep available for inspection by representatives of the STATE and the United States federal government, for a period of 3 years after final payment, the cost records and accounts pertaining to this AGREEMENT. If any litigation, claim, or audit arising out of, in connection with, or related to this contract is initiated before the expiration of the 3-year period, the cost records and accounts shall be retained until such litigation, claim, or audit involving the records is completed.

## **SECTION VI ASSIGNMENT OF TASKS OF WORK**

DRB members shall not assign the work of this AGREEMENT.

## **SECTION VII TERMINATION OF A DRB MEMBER**

DRB members may resign after providing not less than 15 days written notice of their resignation to the STATE and the CONTRACTOR. A DRB member may be terminated, by either party, for failing to comply at all times with all required employment or financial disclosure conditions of DRB membership in conformance with the terms of the contract and this AGREEMENT.

Service of a DRB member may be terminated at any time with not less than 15 days notice as follows:

- A. The State may terminate service of the State appointed member.
- B. The Contractor may terminate service of the Contractor appointed member.
- C. Upon the written recommendation of the State and Contractor appointed members for the removal of the third member.
- D. Upon resignation of a member.

When a member of the DRB is replaced, the replacement member shall be appointed in the same manner as the replaced member was appointed. The appointment of a replacement DRB member will begin promptly upon determination of the need for replacement and shall be completed within 15 days. Changes in either of the DRB members chosen by the 2 parties will not require re-selection of the third member, unless both parties agree to such re-selection in writing. The Dispute Resolution Board Agreement shall be amended to reflect the change of a DRB member.

Each party shall document the need for replacement and substantiate the replacement request in writing to the other party and DRB members.

## **SECTION VIII LEGAL RELATIONS**

The parties hereto mutually understand and agree that each DRB member in the performance of duties is acting in the capacity of an independent agent and not as an employee of either party.

No party to this AGREEMENT shall bear a greater responsibility for damages or personal injury than is normally provided by Federal or State of California Law.

Notwithstanding the provisions of this contract that require the CONTRACTOR to indemnify and hold harmless the STATE, the parties shall jointly indemnify and hold harmless the DRB members from and against all claims, damages, losses, and expenses, including but not limited to attorney's fees, arising out of and resulting from the findings and recommendations of the DRB.

## **SECTION IX CONFIDENTIALITY**

The parties hereto mutually understand and agree that all documents and records provided by the parties in reference to issues brought before the DRB, which documents and records are marked "Confidential - for use by the DRB only," shall be kept in confidence and used only for the purpose of resolution of subject disputes, and for assisting in development of DRB findings and recommendations; that such documents and records will not be utilized or revealed to others, except to officials of the parties who are authorized to act on the subject disputes, for any purposes, during the life of this AGREEMENT. Upon termination of this AGREEMENT, said confidential documents and records, and all copies thereof, shall be returned to the parties who furnished them to the DRB. However, the parties understand that such documents may be subsequently

discoverable and admissible in court or arbitration proceedings unless a protective order has been obtained by the party seeking further confidentiality.

**SECTION X DISPUTES**

Disputes between the parties arising out of the work or other terms of this AGREEMENT, which cannot be resolved by negotiation and mutual concurrence between the parties, or through the administrative process provided in the contract, shall be resolved by arbitration as provided in Section 9-1.10, "Arbitration," of the Standard Specifications. Disputes between the DRB and either party, which cannot be resolved by negotiation and mutual concurrence, shall be resolved in the appropriate forum.

**SECTION XI VENUE, APPLICABLE LAW, AND PERSONAL JURISDICTION**

In the event that any party deems it necessary to institute arbitration proceedings to enforce any right or obligation under this AGREEMENT, the parties hereto agree that such action shall be initiated in the Office of Administrative Hearings of the State of California. The parties hereto agree that all questions shall be resolved by arbitration by application of California law and that the parties to such arbitration shall have the right of appeal from such decisions to the Superior Court in conformance with the laws of the State of California. Venue for the arbitration shall be Sacramento or any other location as agreed to by the parties.

**SECTION XII FEDERAL REVIEW AND REQUIREMENTS**

On Federal-Aid contracts, the Federal Highway Administration shall have the right to review the work of the DRB in progress, except for private meetings or deliberations of the DRB that do not become part of the project records.

Other Federal requirements in this agreement shall only apply to Federal-Aid contracts.

**SECTION XIII CERTIFICATION OF CONTRACTOR, DRB, AND STATE**

IN WITNESS WHEREOF, the parties hereto have executed this AGREEMENT as of the day and year first above written.

DRB MEMBER

DRB MEMBER

By: \_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

Title : \_\_\_\_\_

DRB CHAIRPERSON

By : \_\_\_\_\_

Title : \_\_\_\_\_

CONTRACTOR

CALIFORNIA DEPARTMENT  
OF TRANSPORTATION

By: \_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

**Add:**

**5-1.16-5-17 (BLANK)**

**Add:**

**5-1.18 PROPERTY AND FACILITY PRESERVATION**

**5-1.18A General**

Preserve property and facilities, including:

1. Adjacent property
2. Department's instrumentation
3. ESAs
4. Lands administered by other agencies
5. Railroads and railroad equipment
6. Roadside vegetation not to be removed
7. Utilities
8. Waterways

Immediately report damage to the Engineer.

If you cause damage, you are responsible.

Install sheet piling, cribbing, bulkheads, shores, or other supports necessary to support existing facilities or support material carrying the facilities.

Dispose of temporary facilities when they are no longer needed.

If you damage plants not to be removed:

1. Dispose of them outside the right of way unless the Engineer allows you to reduce them to chips and spread the chips within the highway at locations designated by the Engineer
2. Replace them

Replace plants with plants of the same species.

Replace trees with 24-inch-box trees.

Replace shrubs with No. 15 container shrubs.

Replace ground cover plants with plants from flats. Replace Carpobrutus ground cover plants with plants from cuttings.

Plant ground cover plants 1 foot on center.

If a plant establishment period is specified, replace plants before the start of the plant establishment period; otherwise, replace plants at least 30 days before Contract acceptance.

Water each plant immediately after planting and saturate the backfill soil around and below the roots or ball of earth around the roots of each plant. Water as necessary to maintain plants in a healthy condition until Contract acceptance.

The Department may make a temporary repair to restore service to a damaged facility.

If working on or adjacent to railroad property, do not interfere with railroad operations.

For an excavation on or affecting railroad property, submit work plans showing the system to be used to protect railroad facilities. Allow 65 days for the Engineer's review of the plans. Do not perform work based on the plans until the Engineer notifies you they are accepted.

**5-1.18B Nonhighway Facilities (Including Utilities)**

The Department may rearrange a nonhighway facility during the Contract. Rearrangement of a nonhighway facility includes installation, relocation, alteration, or removal of the facility. The Department may authorize facility owners and their agents to enter the highway to perform rearrangement work for their facilities or to make connections or repairs to their property. Coordinate activities to avoid delays.

Notify the Engineer at least 3 business days before you contact the regional notification center under Govt Code § 4216 et seq. Failure to contact the notification center prohibits excavation.

Before starting work that could damage or interfere with underground infrastructure, locate the infrastructure described in the Contract, including laterals and other appurtenances, and determine the presence of other underground infrastructure inferred from visible facilities such as buildings, meters, or junction boxes.



4. Abuse
5. Unauthorized change
6. Act of God

During the guarantee period, repair or replace each work portion having a substantial defect.

The Department does not pay for corrective work.

During corrective work activities, provide insurance coverage specified for coverage before contract acceptance.

The contract bonds must be in full force and effect until the later of:

1. Expiration of guarantee period
2. Completion of corrective work

If a warranty specification conflicts with Section 6-1.075, "Guarantee," comply with the warranty specification.

During the guarantee period, the Engineer monitors the completed work. If the Engineer finds work having a substantial defect, the Engineer lists work parts and furnishes you the list.

Within 10 days of receipt of the list, submit for authorization a detailed plan for correcting the work. Include a schedule that includes:

1. Start and completion dates
2. List of labor, equipment, materials, and any special services you plan to use
3. Work related to the corrective work, including traffic control and temporary and permanent pavement markings

The Engineer notifies you when the plan is authorized. Start corrective work and related work within 15 days of notice.

If the Engineer determines corrective work is urgently required to prevent injury or property damage:

1. The Engineer furnishes you a request to start emergency repair work and a list of parts requiring corrective work
2. Mobilize within 24 hours and start work
3. Submit a corrective work plan within 5 days of starting emergency repair work

If you fail to perform work as specified, the Department may perform the work and bill you.

**In Section 6-1.08 delete the 2nd paragraph.**

**Add:**

**6-1.085 BUY AMERICA (23 CFR 635.410)**

For a Federal-aid contract, furnish steel and iron materials to be incorporated into the work that are produced in the United States except:

1. Foreign pig iron and processed, pelletized, and reduced iron ore may be used in the domestic production of the steel and iron materials [60 Fed Reg 15478 (03/24/1995)]
2. If the total combined cost of the materials does not exceed the greater of 0.1 percent of the total bid or \$2,500, material produced outside the United States may be used

Production includes:

1. Processing steel and iron materials, including smelting or other processes that alter the physical form or shape (such as rolling, extruding, machining, bending, grinding, and drilling) or chemical composition
2. Coating application, including epoxy coating, galvanizing, and painting, that protects or enhances the value of steel and iron materials

For steel and iron materials to be incorporated into the work, submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications that certifies all production processes occurred in the United States except for the above exceptions.



**In Section 7-1.01A replace the 1st clause with:**

Work on the job site must comply with Labor Code §§ 1727 and 1770-1815 and 8 CA Code of Regs § 16000 et seq. Work includes roadside production and processing of materials.

**In Section 7-1.01A(2) in the 1st paragraph, replace item 3 with:**

3. Upon becoming aware of the subcontractor's failure to pay the specified prevailing rate of wages to the subcontractor's workers, the Contractor must diligently take corrective action to stop or rectify the failure, including withholding sufficient funds due the subcontractor for work performed on the public works project.

**In Section 7-1.01A(2), replace the 2nd paragraph with:**

Pursuant to Section 1775 of the Labor Code, the Division of Labor Standards Enforcement must notify the Contractor on a public works project within 15 days of the receipt by the Division of Labor Standards Enforcement of a complaint of the failure of a subcontractor on that public works project to pay workers the general prevailing rate of per diem wages. If the Division of Labor Standards Enforcement determines that employees of a subcontractor were not paid the general prevailing rate of per diem wages and if the Department did not withhold sufficient money under the contract to pay those employees the balance of wages owed under the general prevailing rate of per diem wages, the Contractor must withhold an amount of moneys due the subcontractor sufficient to pay those employees the general prevailing rate of per diem wages if requested by the Division of Labor Standards Enforcement. The Contractor must pay any money withheld from and owed to a subcontractor upon receipt of notification by the Division of Labor Standards Enforcement that the wage complaint has been resolved. If notice of the resolution of the wage complaint has not been received by the Contractor within 180 days of the filing of a valid notice of completion or acceptance of the public works project, whichever occurs later, the Contractor must pay all moneys withheld from the subcontractor to the Department. The Department withholds these moneys pending the final decision of an enforcement action.

**In Section 7-1.01A(2) replace 7th paragraph with:**

Changes in general prevailing wage determinations apply to the contract when the Director of Industrial Relations has issued them at least 10 days before advertisement (Labor Code § 1773.6 and 8 CA Code of Regs 16204).

**In Section 7-1.01A(3) replace the 2nd paragraph with:**

The Department withholds the penalties specified in subdivision (g) of Labor Code § 1776 for noncompliance with the requirements in Section 1776.

**In Section 7-1.01A(3) replace the 4th paragraph with:**

The Department withholds for delinquent or inadequate payroll records (Labor Code § 1771.5). If the Contractor has not submitted an adequate payroll record by the month's 15th day for the period ending on or before the 1st of that month, the Department withholds 10 percent of the monthly progress estimate, exclusive of mobilization. The Department does not withhold more than \$10,000 or less than \$1,000.

**In Section 7-1.01A(3) delete the 5th paragraph.**

**Replace Section 7-1.01A(6) with:**

**7-1.01A(6) (Blank)**

**Replace Section 7-1.01A(7) with:**

**7-1.01A(7) (Blank)**

**Replace Section 7-1.01F with:**

**7-1.01F Environmental Stewardship**

Comply with Section 14.

**Replace Section 7-1.01I with:**

**7-1.01I (Blank)**

**In Section 7-1.02 in the 2nd paragraph, replace the 4th sentence with:**

Trucks used to haul treated base, portland cement concrete, or hot mix asphalt shall enter onto the base to dump at the nearest practical entry point ahead of spreading equipment.

**In Section 7-1.02 between the 4th and 5th paragraphs, add:**

Loads imposed on existing, new, or partially completed structures shall not exceed the load carrying capacity of the structure or any portion of the structure as determined by AASHTO LRFD with interims and California Amendments, Design Strength Limit State II. The compressive strength of concrete ( $f_c$ ) to be used in computing the load carrying capacity shall be the smaller of the following:

1. Actual compressive strength at the time of loading
2. Value of  $f_c$  shown on the plans for that portion of the structure or 2.5 times the value of  $f_c$  (extreme fiber compressive stress in concrete at service loads) shown on the plans for portions of the structure where no  $f_c$  is shown

**Replace Section 7-1.04 with:**

**7-1.04 PERMITS, LICENSES, AGREEMENTS, AND CERTIFICATIONS**

**7-1.04A General**

Comply with PLACs. The Department makes PLAC changes under Section 4-1.03, "Changes."

**7-1.04B Before Award**

To make a change to a PLAC made available to you before award, submit the proposed change. The Department sends the proposed change to the appropriate authority for consideration.

**7-1.04C After Award**

Confirm with the Engineer which after-award PLACs are obtained by the Department and which are obtained by the Contractor.

To make a change to an after-award PLAC obtained by the Department, submit the proposed change. The Department sends the proposed change to the appropriate authority for consideration.

Obtain those PLACs to be issued to you and pay fees and costs associated with obtaining them. Submit copies of Contractor-obtained after-award PLACs for review.

**In Section 7-1.06 in the 1st paragraph, add:**

The Contractor's Injury and Illness Prevention Program shall be submitted to the Engineer. The program shall address the use of personal and company issued electronic devices during work. The use of entertainment and personal communication devices in the work zone shall not be allowed. Workers may use a communication device for business purposes in the work area, at a location where their safety and the safety of other workers and the traveling public is not compromised.

**Replace Section 7-1.07 with:**

**7-1.07 Lead Compliance Plan**

Section 7-1.07 applies if a bid item for a lead compliance plan is included in the Contract.

Prepare a work plan to prevent or minimize worker exposure to lead while managing and handling earth materials, paint system debris, traffic stripe residue, and pavement marking residue containing lead. Regulations containing specific Cal/OSHA requirements when working with lead include 8 CA Code of Regs § 1532.1.

The plan must contain the items listed in 8 CA Code of Regs § 1532.1(e)(2)(B). Before submittal, a CIH must sign and seal the plan. Submit the plan at least 7 days before starting any activity that presents the potential for lead exposure. The Engineer notifies you of the acceptability of the plan within 4 business days of receipt.

Before starting any activity that presents the potential for lead exposure to employees who have no prior training, including State employees, provide a safety training program to these employees that complies with 8 CA Code of Regs § 1532.1 and your lead compliance program.

Submit copies of air monitoring or job site inspection reports made by or under the direction of the CIH under 8 CA Code of Regs § 1532.1 within 10 days after the date of monitoring or inspection.

Supply personal protective equipment, training, and washing facilities required by your lead compliance plan for 5 State employees.

The contract lump sum price paid for lead compliance plan includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in preparing and implementing the plan as specified in this section.

**Replace Section 7-1.08 with:**

**7-1.08 PUBLIC CONVENIENCE**

Compliance with the provisions of this section does not relieve you of your responsibility for public safety.

Construction activities must not inconvenience the public or abutting property owners. Schedule and conduct work to avoid unnecessary inconvenience to the public and abutting property owners. Avoid undue delay in construction activities to reduce the public's exposure to construction.

Where possible, route traffic on new or existing paved surfaces.

Maintain convenient access to driveways, houses, and buildings. When the abutting property owner's access across the right of way line is to be eliminated or replaced under the contract, the existing access must not be closed until the replacement access facilities are usable. Construct temporary approaches to crossings and intersecting highways.

Provide a reasonably smooth and even surface for use by traffic at all time during excavation of roadways and construction of embankments. Before other grading activities, place fill at culverts and bridges to allow traffic to cross. If ordered, excavate roadway cuts in layers and construct embankments in partial widths at a time alternating construction from one side to the other and routing traffic over the side opposite the one under construction. Install or construct culverts on only 1/2 the width of the traveled way at a time; keep the traveled way portion being used by traffic open and unobstructed until the opposite side of the traveled way is ready for use by traffic.

Upon completion of rough grading or placing any subsequent layer, bring the surface of the roadbed to a smooth and even condition, free of humps and depressions and satisfactory for the use of the public.

After subgrade preparation for a specified layer of material has been completed, repair any damage to the roadbed or completed subgrade, including damage due to use by the public.

While subgrade and paving activities are underway, allow the public to use the shoulders. If half-width paving methods are used, allow the public to use the side of the roadbed opposite the one under construction. If enough width is available, keep open a passageway wide enough to accommodate at least 2 lanes of traffic at locations where subgrade and paving activities are underway. Shape shoulders or reshape subgrade as necessary to accommodate traffic during subgrade preparation and paving activities.

Apply water or dust palliative for the prevention or alleviation of dust nuisance.

Install signs, lights, flares, temporary railing (Type K), barricades and other facilities to direct traffic. Furnish flaggers whenever necessary to direct the movement of the public through or around the work.

You will be required to pay the cost of replacing or repairing all facilities installed under extra work for the convenience or direction or warning of the public which are lost while in your custody, or are damaged by your operations to such an extent as to require replacement or repair.

The Engineer may order or consent to your request to open a completed section of surfacing, pavement, or structure roadway surface for public use. You will not be compensated for any delay to your construction activities caused by the public. This does not relieve you from any other contractual responsibility.

**Replace Section 7-1.09 with:**

**7-1.09 PUBLIC SAFETY**

You are responsible to provide for public safety.

Do not construct a temporary facility that interferes with the safe passage of traffic.

Control dust resulting from the work, inside and outside the right-of-way.

Move workers, equipment, and materials without endangering traffic.

Whenever your operations create a condition hazardous to the public, furnish, erect and maintain those fences, temporary railing, barricades, lights, signs, and other devices and take any other necessary protective measures to prevent damage or injury to the public.

Any fences, temporary railing, barricades, lights, signs, or other devices furnished, erected and maintained by you are in addition to those for which payment is provided elsewhere in the specifications.

Provide flaggers whenever necessary to ensure that the public is given safe guidance through the work zone. Except as ordered, at locations where traffic is being routed through construction under one-way controls, move your equipment in compliance with the one-way controls.

Use of signs, lights, flags, or other protective devices must conform with the California MUTCD and as ordered. Signs, lights, flags or other protective devices must not obscure the visibility of, nor conflict in intent, meaning and function of either existing signs, lights and traffic control devices or any construction area signs or traffic control devices.

Keep existing traffic signals and highway lighting in operation. Other entities perform routine maintenance of these facilities during the work.

Cover signs that direct traffic to a closed area. Providing, maintaining, and removing the covers on construction area signs is paid as extra work under Section 4-1.03D, "Extra Work."

Install temporary illumination in a manner which the illumination and the illumination equipment does not interfere with public safety. The installation of general roadway illumination does not relieve you from furnishing and maintaining any protective devices.

Equipment must enter and leave the highway via existing ramps and crossovers and must move in the direction of public traffic. All movements of workmen and construction equipment on or across lanes open to public traffic must be performed in a manner that will not endanger the public. Your vehicles or other mobile equipment leaving an open traffic lane to enter the construction area, must slow down gradually in advance of the location of the turnoff to give traffic following an opportunity to slow down. When leaving a work area and entering a roadway carrying public traffic, your vehicles and equipment must yield to public traffic.

Immediately remove hauling spillage from roadway lanes or shoulders open to traffic. When hauling on roadways, trim loads and remove material from shelf areas to minimize spillage.

Notify the Engineer not less than 25 days and not more than 125 days before the anticipated start of an activity that will change the vertical or horizontal clearance available to public traffic, including shoulders.

If vertical clearance is temporarily reduced to 15.5 feet or less, place low clearance warning signs in accordance with the California MUTCD and as ordered. Signs must comply with the dimensions, color, and legend requirements of the California MUTCD and these specifications except that the signs must have black letters and numbers on an orange retroreflective background. W12-2P signs must be illuminated so that the signs are clearly visible.

Pave or provide full width continuous and cleared wood walks for pedestrian openings through falsework. Protect pedestrians from falling objects and curing water for concrete. Extend overhead protection for pedestrians not less than 4 feet beyond the edge of the bridge deck. Illuminate all pedestrian openings through falsework. Temporary pedestrian facilities must comply with the American with Disabilities Act of 1990 (ADA).

Do not store vehicles, material, or equipment in a way that:

1. Creates a hazard to the public
2. Obstructs traffic control devices

Do not install or place temporary facilities used to perform the work which interfere with the free and safe passage of public traffic.

Temporary facilities which could be a hazard to public safety if improperly designed shall comply with design requirements specified in the contract for those facilities or, if none are specified, with standard design criteria or codes appropriate for the facility involved. Working drawings and design calculations for the temporary facilities shall be prepared and signed by an engineer who is registered as a Civil Engineer in the State of California and shall be submitted to the Engineer for approval pursuant to Section 5-1.02, "Plans and Working Drawings." The submittals shall designate thereon the standard design criteria or codes used. Installation of the temporary facilities shall not start until the Engineer has reviewed and approved the drawings.

If you appear to be neglectful or negligent in furnishing warning devices and taking protective measures, the Engineer may direct your attention to the existence of a hazard and the necessary warning devices must be furnished and installed and protective measures taken by you. If the Engineer points out the inadequacy of warning devices and protective measures, that action on the part of the Engineer does not relieve you from your responsibility for public safety or abrogate the obligation to furnish and pay for these devices and measures.

Install temporary railing (Type K) or other approved protection system under the following conditions:

1. Excavations: Where the near edge of the excavation is within 15 feet from the edge of an open traffic lane
2. Temporarily Unprotected Permanent Obstacles: When the work includes the installation of a fixed obstacle together with a protective system, such as a sign structure together with protective railing, and you elect to install the obstacle before installing the protective system; or you, for your convenience and as authorized, remove a portion of an existing protective railing at an obstacle and do not replace such railing completely the same day
3. Storage Areas: When material or equipment is stored within 15 feet of the edge of an open traffic lane and the storage is not otherwise prohibited by the provisions of these Standard Specifications and the special provisions

4. Height Differentials: When construction operations create a height differential greater than 0.15 feet within 15 feet of the edge of traffic lane

Temporary railing (Type K) does not need to be installed where excavations within 15 feet from edge of an open traffic lane are:

1. Covered with steel plates or concrete covers of adequate thickness to prevent accidental entry by traffic or the public
2. In side slopes, where the downhill slope is 4:1 (horizontal:vertical) or less unless a naturally occurring condition
3. Protected by existing barrier or railing

Offset the approach end of temporary railing (Type K) a minimum of 15 feet from the edge of an open traffic lane. Install the temporary railing on a skew toward the edge of the traffic lane of not more than one foot transversely to 10 feet longitudinally with respect to the edge of the traffic lane. If the 15-foot minimum offset cannot be achieved, the temporary railing must be installed on the 10 to 1 skew to obtain the maximum available offset between the approach end of the railing and the edge of the traffic lane, and an array of temporary crash cushion modules must be installed at the approach end of the temporary railing.

Secure in place temporary railing (Type K) before starting work for which the temporary railing is required.

Where 2 or more lanes in the same direction are adjacent to the area where the work is being performed, including shoulders, the adjacent lane must be closed under any of the following conditions:

1. Work is off the traveled way but within 6 feet of the edge of traveled way, and approach speed is greater than 45 miles per hour
2. Work is off the traveled way but within 3 feet of the edge of traveled way, and approach speed is less than 45 miles per hour

Closure of the adjacent traffic lane is not required when:

1. Performing work behind a barrier
2. Paving, grinding, or grooving
3. Installing, maintaining, or removing traffic control devices except temporary railing (Type K)

Do not reduce an open traffic lane width to less than 10 feet. When traffic cones or delineators are used for temporary edge delineation, the line of cones or delineators is considered the edge of the traveled way.

If a traffic lane is closed with channelizers for excavation work, move the devices to the adjacent edge of the traveled way when not excavating. Space the devices the same as specified for the lane closure.

Do not move or temporarily suspend anything over a traffic lane open to the public unless the public is protected.

**Replace Section 7-1.11 with:**

**7-1.11 PRESERVATION OF PROPERTY**

Comply with Section 5-1.18, "Property and Facility Preservation."

**Replace Section 7-1.12 with:**

**7-1.12 INDEMNIFICATION AND INSURANCE**

The Contractor's obligations regarding indemnification of the State of California and the requirements for insurance shall conform to the provisions in Section 3-1.05, "Insurance Policies," and Sections 7-1.12A, "Indemnification," and 7-1.12B, "Insurance," of this Section 7-1.12.

**7-1.12A Indemnification**

The Contractor shall defend, indemnify, and save harmless the State, including its officers, employees, and agents (excluding agents who are design professionals) from any and all claims, demands, causes of action, damages, costs, expenses, actual attorneys' fees, losses or liabilities, in law or in equity (Section 7-1.12A Claims) arising out of or in connection with the Contractor's performance of this contract for:

1. Bodily injury including, but not limited to, bodily injury, sickness or disease, emotional injury or death to persons, including, but not limited to, the public, any employees or agents of the Contractor, the State, or any other contractor; and

2. Damage to property of anyone including loss of use thereof; caused or alleged to be caused in whole or in part by any negligent or otherwise legally actionable act or omission of the Contractor or anyone directly or indirectly employed by the Contractor or anyone for whose acts the Contractor may be liable.

Except as otherwise provided by law, these requirements apply regardless of the existence or degree of fault of the State. The Contractor is not obligated to indemnify the State for Claims arising from conduct delineated in Civil Code Section 2782 and to Claims arising from any defective or substandard condition of the highway that existed at or before the start of work, unless this condition has been changed by the work or the scope of the work requires the Contractor to maintain existing highway facilities and the Claim arises from the Contractor's failure to maintain. The Contractor's defense and indemnity obligation shall extend to Claims arising after the work is completed and accepted if the Claims are directly related to alleged acts or omissions by the Contractor that occurred during the course of the work. State inspection is not a waiver of full compliance with these requirements.

The Contractor's obligation to defend and indemnify shall not be excused because of the Contractor's inability to evaluate liability or because the Contractor evaluates liability and determine that the Contractor is not liable. The Contractor shall respond within 30 days to the tender of any Claim for defense and indemnity by the State, unless this time has been extended by the State. If the Contractor fails to accept or reject a tender of defense and indemnity within 30 days, in addition to any other remedy authorized by law, the Department may withhold such funds the State reasonably considers necessary for its defense and indemnity until disposition has been made of the Claim or until the Contractor accepts or rejects the tender of defense, whichever occurs first.

With respect to third-party claims against the Contractor, the Contractor waives all rights of any type to express or implied indemnity against the State, its officers, employees, or agents (excluding agents who are design professionals).

Nothing in the Contract is intended to establish a standard of care owed to any member of the public or to extend to the public the status of a third-party beneficiary for any of these indemnification specifications.

#### **7-1.12B Insurance**

##### **7-1.12B(1) General**

Nothing in the contract is intended to establish a standard of care owed to any member of the public or to extend to the public the status of a third-party beneficiary for any of these insurance specifications.

##### **7-1.12B(2) Casualty Insurance**

The Contractor shall procure and maintain insurance on all of its operations with companies acceptable to the State as follows:

1. The Contractor shall keep all insurance in full force and effect from the beginning of the work through contract acceptance.
2. All insurance shall be with an insurance company with a rating from A.M. Best Financial Strength Rating of A- or better and a Financial Size Category of VII or better.
3. The Contractor shall maintain completed operations coverage with a carrier acceptable to the State through the expiration of the patent deficiency in construction statute of repose set forth in Code of Civil Procedure Section 337.15.

##### **7-1.12B(3) Workers' Compensation and Employer's Liability Insurance**

In accordance with Labor Code Section 1860, the Contractor shall secure the payment of worker's compensation in accordance with Labor Code Section 3700.

In accordance with Labor Code Section 1861, the Contractor shall submit to the Department the following certification before performing the work:

I am aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this contract.

Contract execution constitutes certification submittal.

The Contractor shall provide Employer's Liability Insurance in amounts not less than:

1. \$1,000,000 for each accident for bodily injury by accident
2. \$1,000,000 policy limit for bodily injury by disease
3. \$1,000,000 for each employee for bodily injury by disease

If there is an exposure of injury to the Contractor's employees under the U.S. Longshoremen's and Harbor Workers' Compensation Act, the Jones Act, or under laws, regulations, or statutes applicable to maritime employees, coverage shall be included for such injuries or claims.

**7-1.12B(4) Liability Insurance**

**7-1.12B(4)(a) General**

The Contractor shall carry General Liability and Umbrella or Excess Liability Insurance covering all operations by or on behalf of the Contractor providing insurance for bodily injury liability and property damage liability for the following limits and including coverage for:

1. Premises, operations, and mobile equipment
2. Products and completed operations
3. Broad form property damage (including completed operations)
4. Explosion, collapse, and underground hazards
5. Personal injury
6. Contractual liability

**7-1.12B(4)(b) Liability Limits/Additional Insureds**

The limits of liability shall be at least the amounts shown in the following table:

Total Bid	For Each Occurrence <sup>1</sup>	Aggregate for Products/Completed Operation	General Aggregate <sup>2</sup>	Umbrella or Excess Liability <sup>3</sup>
≤\$1,000,000	\$1,000,000	\$2,000,000	\$2,000,000	\$5,000,000
>\$1,000,000 ≤\$10,000,000	\$1,000,000	\$2,000,000	\$2,000,000	\$10,000,000
>\$10,000,000 ≤\$25,000,000	\$2,000,000	\$2,000,000	\$4,000,000	\$15,000,000
>\$25,000,000	\$2,000,000	\$2,000,000	\$4,000,000	\$25,000,000
<ol style="list-style-type: none"> <li>1. Combined single limit for bodily injury and property damage.</li> <li>2. This limit shall apply separately to the Contractor's work under this contract.</li> <li>3. The umbrella or excess policy shall contain a clause stating that it takes effect (drops down) in the event the primary limits are impaired or exhausted.</li> </ol>				

The Contractor shall not require certified Small Business subcontractors to carry Liability Insurance that exceeds the limits in the table above. Notwithstanding the limits specified herein, at the option of the Contractor, the liability insurance limits for certified Small Business subcontractors of any tier may be less than those limits specified in the table. For Small Business subcontracts, "Total Bid" shall be interpreted as the amount of subcontracted work to a certified Small Business.

The State, including its officers, directors, agents (excluding agents who are design professionals), and employees, shall be named as additional insureds under the General Liability and Umbrella Liability Policies with respect to liability arising out of or connected with work or operations performed by or on behalf of the Contractor under this contract. Coverage for such additional insureds does not extend to liability:

1. Arising from any defective or substandard condition of the roadway which existed at or before the time the Contractor started work, unless such condition has been changed by the work or the scope of the work requires the Contractor to maintain existing roadway facilities and the claim arises from the Contractor's failure to maintain;
2. For claims occurring after the work is completed and accepted unless these claims are directly related to alleged acts or omissions of the Contractor that occurred during the course of the work; or
3. To the extent prohibited by Insurance Code Section 11580.04

Additional insured coverage shall be provided by a policy provision or by an endorsement providing coverage at least as broad as Additional Insured (Form B) endorsement form CG 2010, as published by the Insurance Services Office (ISO), or other form designated by the Department.

**7-1.12B(4)(c) Contractor's Insurance Policy is Primary**

The policy shall stipulate that the insurance afforded the additional insureds applies as primary insurance. Any other insurance or self-insurance maintained by the State is excess only and shall not be called upon to contribute with this insurance.

#### **7-1.12B(5) Automobile Liability Insurance**

The Contractor shall carry automobile liability insurance, including coverage for all owned, hired, and nonowned automobiles. The primary limits of liability shall be not less than \$1,000,000 combined single limit each accident for bodily injury and property damage. The umbrella or excess liability coverage required under Section 7-1.12B(4)(b) also applies to automobile liability.

#### **7-1.12B(6) Policy Forms, Endorsements, and Certificates**

The Contractor shall provide its General Liability Insurance under Commercial General Liability policy form No. CG0001 as published by the Insurance Services Office (ISO) or under a policy form at least as broad as policy form No. CG0001.

#### **7-1.12B(7) Deductibles**

The State may expressly allow deductible clauses, which it does not consider excessive, overly broad, or harmful to the interests of the State. Regardless of the allowance of exclusions or deductions by the State, the Contractor is responsible for any deductible amount and shall warrant that the coverage provided to the State is in accordance with Section 7-1.12B, "Insurance."

#### **7-1.12B(8) Enforcement**

The Department may assure the Contractor's compliance with its insurance obligations. Ten days before an insurance policy lapses or is canceled during the contract period, the Contractor shall submit to the Department evidence of renewal or replacement of the policy.

If the Contractor fails to maintain any required insurance coverage, the Department may maintain this coverage and withhold or charge the expense to the Contractor or terminate the Contractor's control of the work in accordance with Section 8-1.08, "Termination of Control."

The Contractor is not relieved of its duties and responsibilities to indemnify, defend, and hold harmless the State, its officers, agents, and employees by the Department's acceptance of insurance policies and certificates.

Minimum insurance coverage amounts do not relieve the Contractor for liability in excess of such coverage, nor do they preclude the State from taking other actions available to it, including the withholding of funds under this contract.

#### **7-1.12B(9) Self-Insurance**

Self-insurance programs and self-insured retentions in insurance policies are subject to separate annual review and approval by the State.

If the Contractor uses a self-insurance program or self-insured retention, the Contractor shall provide the State with the same protection from liability and defense of suits as would be afforded by first-dollar insurance. Execution of the contract is the Contractor's acknowledgment that the Contractor will be bound by all laws as if the Contractor were an insurer as defined under Insurance Code Section 23 and that the self-insurance program or self-insured retention shall operate as insurance as defined under Insurance Code Section 22.

### **Replace Section 7-1.125 with:**

#### **7-1.125 Legal Actions Against the Department**

If legal action is brought against the Department over compliance with a State or Federal law, rule, or regulation applicable to highway work, then:

1. If the Department, in complying with a court order, prohibits you from performing work, the resulting delay is a suspension related to your performance, unless the Department terminates the contract.
2. If a court order other than an order to show cause or the final judgment in the action prohibits the Department from requiring you to perform work, the Department may delete the prohibited work or terminate the contract.

**In Section 7-1.13 delete the 5th and 6th paragraphs.**

**Add:**

**7-1.50 FEDERAL LAWS FOR FEDERAL-AID CONTRACTS**

**7-1.50A General**

Section 7-1.50, "Federal Laws for Federal-Aid Contracts," includes specifications required in a Federal-aid construction contract and applies to a Federal-aid contract.

Form FHWA-1273 is included in the contract in Section 7-1.50B, "FHWA-1273." Some contract terms on the form are different than those used in other contract parts as shown in the following table:

<b>FHWA-1273 Terms and Department Equivalencies</b>	
<b>FHWA-1273 Term</b>	<b>Equivalent Term Used in Other Contract Parts</b>
SHA	Department
SHA contracting officer	Engineer
SHA resident engineer	Engineer

**7-1.50B FHWA-1273**

FHWA-1273 Electronic version -- March 10, 1994  
with revised Section VI

**REQUIRED CONTRACT PROVISIONS FEDERAL-AID CONSTRUCTION CONTRACTS**

- I. General
- II. Nondiscrimination
- III. Nonsegregated Facilities
- IV. Payment of Predetermined Minimum Wage
- V. Statements and Payrolls
- VI. Record of Materials, Supplies, and Labor
- VII. Subletting or Assigning the Contract
- VIII. Safety: Accident Prevention
- IX. False Statements Concerning Highway Projects
- X. Implementation of Clean Air Act and Federal Water Pollution Control Act
- XI. Certification Regarding Debarment, Suspension, Ineligibility, and Voluntary Exclusion
- XII. Certification Regarding Use of Contract Funds for Lobbying

**ATTACHMENTS**

- A. Employment Preference for Appalachian Contracts (included in Appalachian contracts only)

**I. GENERAL**

- 1. These contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.
- 2. Except as otherwise provided for in each section, the contractor shall insert in each subcontract all of the stipulations contained in these Required Contract Provisions, and further require their inclusion in any lower tier subcontract or purchase order that may in turn be made. The Required Contract Provisions shall not be incorporated by reference in any case. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with these Required Contract Provisions.
- 3. A breach of any of the stipulations contained in these Required Contract Provisions shall be sufficient grounds for termination of the contract.
- 4. A breach of the following clauses of the Required Contract Provisions may also be grounds for debarment as provided in 29 CFR 5.12:

Section I, paragraph 2;  
Section IV, paragraphs 1, 2, 3, 4, and 7;  
Section V, paragraphs 1 and 2a through 2g.

- 5. Disputes arising out of the labor standards provisions of Section IV (except paragraph 5) and Section V of these Required Contract Provisions shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the U.S. Department of Labor (DOL) as set forth in 29 CFR 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the DOL, or the contractor's employees or their representatives.

6. **Selection of Labor:** During the performance of this contract, the contractor shall not:
  - a. discriminate against labor from any other State, possession, or territory of the United States (except for employment preference for Appalachian contracts, when applicable, as specified in Attachment A), or
  - b. employ convict labor for any purpose within the limits of the project unless it is labor performed by convicts who are on parole, supervised release, or probation.

## II. NONDISCRIMINATION

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more.)

1. **Equal Employment Opportunity:** Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630 and 41 CFR 60) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The Equal Opportunity Construction Contract Specifications set forth under 41 CFR 60-4.3 and the provisions of the American Disabilities Act of 1990 (42 U.S.C. 12101 *et seq.*) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:
  - a. The contractor will work with the State highway agency (SHA) and the Federal Government in carrying out EEO obligations and in their review of his/her activities under the contract.
  - b. The contractor will accept as his operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, preapprenticeship, and/or on-the-job training."
2. **EEO Officer:** The contractor will designate and make known to the SHA contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active contractor program of EEO and who must be assigned adequate authority and responsibility to do so.
3. **Dissemination of Policy:** All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:
  - a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.
  - b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.
  - c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minority group employees.
  - d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.
  - e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.
4. **Recruitment:** When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minority groups in the area from which the project work force would normally be derived.
  - a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minority group applicants. To meet this requirement, the contractor will identify sources of potential minority group employees,

- and establish with such identified sources procedures whereby minority group applicants may be referred to the contractor for employment consideration.
- b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, he is expected to observe the provisions of that agreement to the extent that the system permits the contractor's compliance with EEO contract provisions. (The DOL has held that where implementation of such agreements have the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Executive Order 11246, as amended.)
  - c. The contractor will encourage his present employees to refer minority group applicants for employment. Information and procedures with regard to referring minority group applicants will be discussed with employees.
5. **Personnel Actions:** Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:
- a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.
  - b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.
  - c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.
  - d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with his obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of his avenues of appeal.
6. **Training and Promotion:**
- a. The contractor will assist in locating, qualifying, and increasing the skills of minority group and women employees, and applicants for employment.
  - b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision.
  - c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.
  - d. The contractor will periodically review the training and promotion potential of minority group and women employees and will encourage eligible employees to apply for such training and promotion.
7. **Unions:** If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use his/her best efforts to obtain the cooperation of such unions to increase opportunities for minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. Actions by the contractor either directly or through a contractor's association acting as agent will include the procedures set forth below:
- a. The contractor will use best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority group members and women for membership in the unions and increasing the skills of minority group employees and women so that they may qualify for higher paying employment.
  - b. The contractor will use best efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.
  - c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to

furnish such information to the contractor, the contractor shall so certify to the SHA and shall set forth what efforts have been made to obtain such information.

- d. In the event the union is unable to provide the contractor with a reasonable flow of minority and women referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minority group persons and women. (The DOL has held that it shall be no excuse that the union with which the contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees.) In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these specifications, such contractor shall immediately notify the SHA.
8. **Selection of Subcontractors, Procurement of Materials and Leasing of Equipment:** The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment.
- a. The contractor shall notify all potential subcontractors and suppliers of his/her EEO obligations under this contract.
  - b. Disadvantaged business enterprises (DBE), as defined in 49 CFR 23, shall have equal opportunity to compete for and perform subcontracts which the contractor enters into pursuant to this contract. The contractor will use his best efforts to solicit bids from and to utilize DBE subcontractors or subcontractors with meaningful minority group and female representation among their employees. Contractors shall obtain lists of DBE construction firms from SHA personnel.
  - c. The contractor will use his best efforts to ensure subcontractor compliance with their EEO obligations.
9. **Records and Reports:** The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the SHA and the FHWA.
- a. The records kept by the contractor shall document the following:
    1. The number of minority and non-minority group members and women employed in each work classification on the project;
    2. The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women;
    3. The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees; and
    4. The progress and efforts being made in securing the services of DBE subcontractors or subcontractors with meaningful minority and female representation among their employees.
  - b. The contractors will submit an annual report to the SHA each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data.

### III. NONSEGREGATED FACILITIES

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more.)

- a. By submission of this bid, the execution of this contract or subcontract, or the consummation of this material supply agreement or purchase order, as appropriate, the bidder, Federal-aid construction contractor, subcontractor, material supplier, or vendor, as appropriate, certifies that the firm does not maintain or provide for its employees any segregated facilities at any of its establishments, and that the firm does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The firm agrees that a breach of this certification is a violation of the EEO provisions of this contract. The firm further certifies that no employee will be denied access to adequate facilities on the basis of sex or disability.
- b. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, timeclocks, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are, in fact, segregated on the basis of race, color, religion,

national origin, age or disability, because of habit, local custom, or otherwise. The only exception will be for the disabled when the demands for accessibility override (e.g. disabled parking).

- c. The contractor agrees that it has obtained or will obtain identical certification from proposed subcontractors or material suppliers prior to award of subcontracts or consummation of material supply agreements of \$10,000 or more and that it will retain such certifications in its files.

#### **IV. PAYMENT OF PREDETERMINED MINIMUM WAGE**

(Applicable to all Federal-aid construction contracts exceeding \$2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural minor collectors, which are exempt.)

##### **1. General:**

- a. All mechanics and laborers employed or working upon the site of the work will be paid unconditionally and not less often than once a week and without subsequent deduction or rebate on any account [except such payroll deductions as are permitted by regulations (29 CFR 3) issued by the Secretary of Labor under the Copeland Act (40 U.S.C. 276c)] the full amounts of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment. The payment shall be computed at wage rates not less than those contained in the wage determination of the Secretary of Labor (hereinafter "the wage determination") which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor or its subcontractors and such laborers and mechanics. The wage determination (including any additional classifications and wage rates conformed under paragraph 2 of this Section IV and the DOL poster (WH-1321) or Form FHWA-1495) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. For the purpose of this Section, contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b) (2) of the Davis- Bacon Act (40 U.S.C. 276a) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of Section IV, paragraph 3b, hereof. Also, for the purpose of this Section, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in paragraphs 4 and 5 of this Section IV.
- b. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein, provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed.
- c. All rulings and interpretations of the Davis-Bacon Act and related acts contained in 29 CFR 1, 3, and 5 are herein incorporated by reference in this contract.

##### **2. Classification:**

- a. The SHA contracting officer shall require that any class of laborers or mechanics employed under the contract, which is not listed in the wage determination, shall be classified in conformance with the wage determination.
- b. The contracting officer shall approve an additional classification, wage rate and fringe benefits only when the following criteria have been met:
  1. the work to be performed by the additional classification requested is not performed by a classification in the wage determination;
  2. the additional classification is utilized in the area by the construction industry;
  3. the proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and
  4. with respect to helpers, when such a classification prevails in the area in which the work is performed.
- c. If the contractor or subcontractors, as appropriate, the laborers and mechanics (if known) to be employed in the additional classification or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the DOL, Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, D.C. 20210. The Wage and Hour Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

- d. In the event the contractor or subcontractors, as appropriate, the laborers or mechanics to be employed in the additional classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. Said Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.
- e. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 2c or 2d of this Section IV shall be paid to all workers performing work in the additional classification from the first day on which work is performed in the classification.

**3. Payment of Fringe Benefits:**

- a. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor or subcontractors, as appropriate, shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly case equivalent thereof.
- b. If the contractor or subcontractor, as appropriate, does not make payments to a trustee or other third person, he/she may consider as a part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

**4. Apprentices and Trainees (Programs of the U.S. DOL) and Helpers:**

a. Apprentices:

- 1. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the DOL, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau, or if a person is employed in his/her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State apprenticeship agency (where appropriate) to be eligible for probationary employment as an apprentice.
- 2. The allowable ratio of apprentices to journeyman-level employees on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate listed in the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor or subcontractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman-level hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.
- 3. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator for the Wage and Hour Division determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.
- 4. In the event the Bureau of Apprenticeship and Training, or a State apprenticeship agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor or subcontractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the comparable work performed by regular employees until an acceptable program is approved.

b. Trainees:

1. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the DOL, Employment and Training Administration.
2. The ratio of trainees to journeyman-level employees on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.
3. Every trainee must be paid at not less than the rate specified in the approved program for his/her level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman-level wage rate on the wage determination which provides for less than full fringe benefits for apprentices, in which case such trainees shall receive the same fringe benefits as apprentices.
4. In the event the Employment and Training Administration withdraws approval of a training program, the contractor or subcontractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. **Helpers:**

Helpers will be permitted to work on a project if the helper classification is specified and defined on the applicable wage determination or is approved pursuant to the conformance procedure set forth in Section IV.2. Any worker listed on a payroll at a helper wage rate, who is not a helper under an approved definition, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed.

5. **Apprentices and Trainees (Programs of the U.S. DOT):**

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

6. **Withholding:**

The SHA shall upon its own action or upon written request of an authorized representative of the DOL withhold, or cause to be withheld, from the contractor or subcontractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements which is held by the same prime contractor, as much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the SHA contracting officer may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

7. **Overtime Requirements:**

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, watchmen, or guards (including apprentices, trainees, and helpers described in paragraphs 4 and 5 above) shall require or permit any laborer, mechanic, watchman, or guard in any workweek in which he/she is employed on such work, to work in excess of 40 hours in such workweek unless such laborer, mechanic, watchman, or guard receives compensation at a rate not less than one-and-one-half times his/her basic rate of pay for all hours worked in excess of 40 hours in such workweek.

8. **Violation:**

Liability for Unpaid Wages; Liquidated Damages: In the event of any violation of the clause set forth in paragraph 7 above, the contractor and any subcontractor responsible thereof shall be liable to the affected employee for his/her unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory) for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer, mechanic, watchman, or guard employed in violation of the clause set forth in paragraph 7, in the sum of \$10 for each calendar day on which such employee was required or permitted to work in excess of the standard work week of 40 hours without payment of the overtime wages required by the clause set forth in paragraph 7.

**9. Withholding for Unpaid Wages and Liquidated Damages:**

The SHA shall upon its own action or upon written request of any authorized representative of the DOL withhold, or cause to be withheld, from any monies payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to the contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 8 above.

**V. STATEMENTS AND PAYROLLS**

(Applicable to all Federal-aid construction contracts exceeding \$2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural collectors, which are exempt.)

**1. Compliance with Copeland Regulations (29 CFR 3):**

The contractor shall comply with the Copeland Regulations of the Secretary of Labor which are herein incorporated by reference.

**2. Payrolls and Payroll Records:**

- a. Payrolls and basic records relating thereto shall be maintained by the contractor and each subcontractor during the course of the work and preserved for a period of 3 years from the date of completion of the contract for all laborers, mechanics, apprentices, trainees, watchmen, helpers, and guards working at the site of the work.
- b. The payroll records shall contain the name, social security number, and address of each such employee; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalent thereof the types described in Section 1(b)(2)(B) of the Davis Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. In addition, for Appalachian contracts, the payroll records shall contain a notation indicating whether the employee does, or does not, normally reside in the labor area as defined in Attachment A, paragraph 1. Whenever the Secretary of Labor, pursuant to Section IV, paragraph 3b, has found that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis Bacon Act, the contractor and each subcontractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, that the plan or program has been communicated in writing to the laborers or mechanics affected, and show the cost anticipated or the actual cost incurred in providing benefits. Contractors or subcontractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprentices and trainees, and ratios and wage rates prescribed in the applicable programs.
- c. Each contractor and subcontractor shall furnish, each week in which any contract work is performed, to the SHA resident engineer a payroll of wages paid each of its employees (including apprentices, trainees, and helpers, described in Section IV, paragraphs 4 and 5, and watchmen and guards engaged on work during the preceding weekly payroll period). The payroll submitted shall set out accurately and completely all of the information required to be maintained under paragraph 2b of this Section V. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal stock number 029- 005-0014-1), U.S. Government Printing Office, Washington, D.C. 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors.
- d. Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his/her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:
  1. that the payroll for the payroll period contains the information required to be maintained under paragraph 2b of this Section V and that such information is correct and complete;

2. that such laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR 3;
  3. that each laborer or mechanic has been paid not less than the applicable wage rate and fringe benefits or cash equivalent for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.
- e. The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 2d of this Section V.
  - f. The falsification of any of the above certifications may subject the contractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 231.
  - g. The contractor or subcontractor shall make the records required under paragraph 2b of this Section V available for inspection, copying, or transcription by authorized representatives of the SHA, the FHWA, or the DOL, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the SHA, the FHWA, the DOL, or all may, after written notice to the contractor, sponsor, applicant, or owner, take such actions as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

## **VI. RECORD OF MATERIALS, SUPPLIES, AND LABOR**

(As of May 22, 2007, Form FHWA-47 is no longer required.)

## **VII. SUBLETTING OR ASSIGNING THE CONTRACT**

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the State. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635).
  - a. "Its own organization" shall be construed to include only workers employed and paid directly by the prime contractor and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor, assignee, or agent of the prime contractor.
  - b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid on the contract as a whole and in general are to be limited to minor components of the overall contract.
2. The contract amount upon which the requirements set forth in paragraph 1 of Section VII is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.
3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the SHA contracting officer determines is necessary to assure the performance of the contract.
4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the SHA contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the SHA has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

## **VIII. SAFETY: ACCIDENT PREVENTION**

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the SHA contracting officer may

determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).
3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

#### **IX. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS**

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by Engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, the following notice shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

#### **NOTICE TO ALL PERSONNEL ENGAGED ON FEDERAL-AID HIGHWAY PROJECTS**

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined not more than \$10,000 or imprisoned not more than 5 years or both."

#### **X. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT**

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$100,000 or more.)

By submission of this bid or the execution of this contract, or subcontract, as appropriate, the bidder, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any facility that is or will be utilized in the performance of this contract, unless such contract is exempt under the Clean Air Act, as amended (42 U.S.C. 1857 *et seq.*, as amended by Pub.L. 91-604), and under the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 *et seq.*, as amended by Pub.L. 92-500), Executive Order 11738, and regulations in implementation thereof (40 CFR 15) is not listed, on the date of contract award, on the U.S. Environmental Protection Agency (EPA) List of Violating Facilities pursuant to 40 CFR 15.20.
2. That the firm agrees to comply and remain in compliance with all the requirements of Section 114 of the Clean Air Act and Section 308 of the Federal Water Pollution Control Act and all regulations and guidelines listed thereunder.
3. That the firm shall promptly notify the SHA of the receipt of any communication from the Director, Office of Federal Activities, EPA, indicating that a facility that is or will be utilized for the contract is under consideration to be listed on the EPA List of Violating Facilities.
4. That the firm agrees to include or cause to be included the requirements of paragraph 1 through 4 of this Section X in every nonexempt subcontract, and further agrees to take such action as the government may direct as a means of enforcing such requirements.

## **XI. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION**

### **1. Instructions for Certification - Primary Covered Transactions:**

(Applicable to all Federal-aid contracts - 49 CFR 29)

- a. By signing and submitting this proposal, the prospective primary participant is providing the certification set out below.
- b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective primary participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.
- c. The certification in this clause is a material representation of fact upon which reliance was placed when the department or agency determined to enter into this transaction. If it is later determined that the prospective primary participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause of default.
- d. The prospective primary participant shall provide immediate written notice to the department or agency to whom this proposal is submitted if any time the prospective primary participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
- e. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the department or agency to which this proposal is submitted for assistance in obtaining a copy of those regulations.
- f. The prospective primary participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.
- g. The prospective primary participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
- h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the nonprocurement portion of the "Lists of Parties Excluded From Federal Procurement or Nonprocurement Programs" (Nonprocurement List) which is compiled by the General Services Administration.
- i. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
- j. Except for transactions authorized under paragraph f of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

\* \* \* \* \*

### **Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Primary Covered Transactions**

1. The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:
  - a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

- b. Have not within a 3-year period preceding this proposal been convicted of or had a civil judgement rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
  - c. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph 1b of this certification; and
  - d. Have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.
2. Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

\* \* \* \* \*

**2. Instructions for Certification - Lower Tier Covered Transactions:**

(Applicable to all subcontracts, purchase orders and other lower tier transactions of \$25,000 or more - 49 CFR 29)

- a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.
- b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
- c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.
- d. The terms "covered transaction," "debarred," "suspended," "ineligible," "primary covered transaction," "participant," "person," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.
- e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
- f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
- g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.
- h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
- i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

\* \* \* \* \*

**Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Covered Transactions:**

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

\* \* \* \* \*

**XII. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING**

(Applicable to all Federal-aid construction contracts and to all related subcontracts which exceed \$100,000 - 49 CFR 20)

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:
  - a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
  - b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.
3. The prospective participant also agrees by submitting his or her bid or proposal that he or she shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such recipients shall certify and disclose accordingly.

**7-1.50C Female and Minority Goals**

To comply with Section II, "Nondiscrimination," of "Required Contract Provisions Federal-Aid Construction Contracts," the Department is including in Section 7-1.50C, "Female and Minority Goals," female and minority utilization goals for Federal-aid construction contracts and subcontracts that exceed \$10,000.

The nationwide goal for female utilization is 6.9 percent.

The goals for minority utilization [45 Fed Reg 65984 (10/3/1980)] are as follows:

**Minority Utilization Goals**

Economic Area		Goal (Percent)
174	Redding CA: Non-SMSA Counties: CA Lassen; CA Modoc; CA Plumas; CA Shasta; CA Siskiyou; CA Tehama	6.8
175	Eureka, CA Non-SMSA Counties: CA Del Norte; CA Humboldt; CA Trinity	6.6
176	San Francisco-Oakland-San Jose, CA: SMSA Counties: 7120 Salinas-Seaside-Monterey, CA CA Monterey 7360 San Francisco-Oakland CA Alameda; CA Contra Costa; CA Marin; CA San Francisco; CA San Mateo 7400 San Jose, CA CA Santa Clara, CA 7485 Santa Cruz, CA CA Santa Cruz 7500 Santa Rosa CA Sonoma 8720 Vallejo-Fairfield-Napa, CA CA Napa; CA Solano Non-SMSA Counties: CA Lake; CA Mendocino; CA San Benito	28.9  25.6   19.6  14.9  9.1  17.1  23.2
177	Sacramento, CA: SMSA Counties: 6920 Sacramento, CA CA Placer; CA Sacramento; CA Yolo Non-SMSA Counties CA Butte; CA Colusa; CA El Dorado; CA Glenn; CA Nevada; CA Sierra; CA Sutter; CA Yuba	16.1  14.3
178	Stockton-Modesto, CA: SMSA Counties: 5170 Modesto, CA CA Stanislaus 8120 Stockton, CA CA San Joaquin Non-SMSA Counties CA Alpine; CA Amador; CA Calaveras; CA Mariposa; CA Merced; CA Toulumne	12.3  24.3  19.8
179	Fresno-Bakersfield, CA SMSA Counties: 0680 Bakersfield, CA CA Kern 2840 Fresno, CA CA Fresno Non-SMSA Counties: CA Kings; CA Madera; CA Tulare	19.1  26.1  23.6
180	Los Angeles, CA: SMSA Counties: 0360 Anaheim-Santa Ana-Garden Grove, CA CA Orange 4480 Los Angeles-Long Beach, CA CA Los Angeles 6000 Oxnard-Simi Valley-Ventura, CA CA Ventura 6780 Riverside-San Bernardino-Ontario, CA	11.9  28.3  21.5  19.0

	CA Riverside; CA San Bernardino 7480 Santa Barbara-Santa Maria-Lompoc, CA CA Santa Barbara Non-SMSA Counties	19.7 24.6
181	CA Inyo; CA Mono; CA San Luis Obispo San Diego, CA: SMSA Counties 7320 San Diego, CA CA San Diego Non-SMSA Counties CA Imperial	16.9 18.2

For each July during which work is performed under the contract, you and each non-material-supplier subcontractor with a subcontract of \$10,000 or more must complete Form FHWA PR-1391 (Appendix C to 23 CFR 230). Submit the forms by August 15.

**7-1.50D Training**

Section 7-1.50D, "Training," applies if a number of trainees or apprentices is specified in the special provisions.

As part of your equal opportunity affirmative action program, provide on-the-job training to develop full journeymen in the types of trades or job classifications involved.

You have primary responsibility for meeting this training requirement.

If you subcontract a contract part, determine how many trainees or apprentices are to be trained by the subcontractor.

Include these training requirements in your subcontract.

Where feasible, 25 percent of apprentices or trainees in each occupation must be in their 1st year of apprenticeship or training.

Distribute the number of apprentices or trainees among the work classifications on the basis of your needs and the availability of journeymen in the various classifications within a reasonable recruitment area.

Before starting work, submit to the Department:

1. Number of apprentices or trainees to be trained for each classification
2. Training program to be used
3. Training starting date for each classification

Obtain the Department's approval for this submitted information before you start work. The Department credits you for each apprentice or trainee you employ on the work who is currently enrolled or becomes enrolled in an approved program.

The primary objective of Section 7-1.50D, "Training," is to train and upgrade minorities and women toward journeyman status. Make every effort to enroll minority and women apprentices or trainees, such as conducting systematic and direct recruitment through public and private sources likely to yield minority and women apprentices or trainees, to the extent they are available within a reasonable recruitment area. Show that you have made the efforts. In making these efforts, do not discriminate against any applicant for training.

Do not employ as an apprentice or trainee an employee:

1. In any classification in which the employee has successfully completed a training course leading to journeyman status or in which the employee has been employed as a journeyman
2. Who is not registered in a program approved by the US Department of Labor, Bureau of Apprenticeship and Training

Ask the employee if the employee has successfully completed a training course leading to journeyman status or has been employed as a journeyman. Your records must show the employee's answers to the questions.

In your training program, establish the minimum length and training type for each classification. The Department and FHWA approves a program if one of the following is met:

1. It is calculated to:
  - 1.1. Meet the your equal employment opportunity responsibilities
  - 1.2. Qualify the average apprentice or trainee for journeyman status in the classification involved by the end of the training period



**8-1.025 PRECONSTRUCTION CONFERENCE**

Attend a preconstruction conference with key personnel, including your assigned representative, at a time and location determined by the Engineer. Submit documents as required before the preconstruction conference. You may begin work before the preconstruction conference.

Be prepared to discuss the following topics and documents:

Topics	Document
Potential claim and dispute resolution	Potential claim forms
Contractor's representation	Assignment of Contractor's representative
DBE and DVBE	Final utilization reports
Equipment	Equipment list
Labor compliance and equal employment opportunity	Job site posters and benefit and payroll reports
Material inspection	Notice of Materials to be Used
Materials on hand	Request for Payment for Materials on Hand
Measurements	--
Partnering	Field Guide to Partnering on Caltrans Construction Projects
Quality control	QC plans
Safety	Injury and Illness Prevention Program and job site posters
Schedule	Baseline schedule and Weekly Statement of Working Days
Subcontracting	Subcontracting Request
Surveying	Survey Request
Traffic control	Traffic contingency plan and traffic control plans
Utility work	--
Weight limitations	--
Water pollution control	SWPPP or WPCP
Work restrictions	PLACs
Working drawings	--

**8-1.03 BEGINNING OF WORK**

Begin work within 15 days after receiving notice that the contract has been approved by the Attorney General or the attorney appointed and authorized to represent the Department. Submit a written notice 72 hours before beginning work. If the project has more than one location of work, submit a separate notice for each location.

You may begin work before receiving the notice of contract approval if you:

1. Deliver the signed contract, bonds, and evidence of insurance to the Department
2. Submit 72-hour notice
3. Obtain an encroachment permit from the Department
4. Are authorized by the Department to begin
5. Perform work at your own risk
6. Perform work under the contract

The Engineer does not count working days for days worked before contract approval.

If the contract is approved, work already performed that complies with the contract is authorized.

If the contract does not get approved, leave the job site in a neat condition. If a facility has been changed, restore it to its former or equivalent condition at your expense.

The Department does not adjust time for beginning before the approval date.

**8-1.04 PROGRESS SCHEDULE**

**8-1.04A General**

Reserved

**8-1.04B Critical Path Method Schedule**

The following definitions apply to critical path method schedules:

**activity:** Task, event, or other project element on a schedule that contributes to completing the project. Activities have a description, start date, finish date, duration, and one or more logic ties.

**baseline schedule:** The initial schedule showing the original work plan beginning on the date of contract approval. This schedule shows no completed work to date and no negative float or negative lag to any activity.

**controlling activity:** Construction activity that extends the scheduled completion date if delayed.

**critical path:** Longest continuous chain of activities for the project that has the least amount of total float of all chains. In general, a delay on the critical path extends the scheduled completion date.

**critical path method (CPM):** Network based planning technique using activity durations and relationships between activities to calculate a schedule for the entire project.

**revised schedule:** Schedule that incorporates a proposed or past change to logic or activity durations.

**scheduled completion date:** Planned project completion date shown on the current schedule.

**updated schedule:** Current schedule developed from the accepted baseline and any subsequent accepted updated or revised schedules through regular monthly review to incorporate actual past progress.

Before or at the preconstruction conference, submit a CPM baseline schedule.

Submit a monthly updated schedule that includes the status of work completed to date and the work yet to be performed as planned.

On each schedule, show:

1. Planned and actual start and completion date of each work activity, including applicable:
  - 1.1. Submittal development
  - 1.2. Submittal review and approval
  - 1.3. Material procurement
  - 1.4. Contract milestones and constraints
  - 1.5. Equipment and plant setup
  - 1.6. Interfaces with outside entities
  - 1.7. Erection and removal of falsework and shoring
  - 1.8. Test periods
  - 1.9. Major traffic stage change
  - 1.10. Final cleanup
2. Order that you propose to prosecute the work
3. Logical links between the time-scaled work activities
4. All controlling activities
5. Legible description of each activity
6. At least one predecessor and one successor to each activity, except for project start and project end milestones
7. Duration of not less than one working day for each activity
8. Start milestone date as the contract approval date

You may include changes on updated schedules that do not alter the critical path or extend the schedule completion date compared to the current schedule. Changes may include:

1. Adding or deleting activities
2. Changing activity constraints
3. Changing durations
4. Changing logic

If any proposed change in planned work results in altering the critical path or extending the scheduled completion date, submit a revised schedule within 15 days of the proposed change.

For each schedule submittal:

1. Submit a plotted original, time-scaled network diagram on a sheet of at least 8.5" x 11" with a title block and timeline
2. If a computer program is used to make the schedule, submit a read-only compact disc or diskette containing the schedule data. Label the compact disc or diskette with:
  - 2.1. Contract number
  - 2.2. CPM schedule number and date produced
  - 2.3. File name

If there is no contract item for progress schedule (critical path method), full compensation for this work is included in the contract prices paid for the items of work involved, and no additional compensation will be allowed therefor.

## **8-1.05 TEMPORARY SUSPENSION OF WORK**

### **8-1.05A General**

The Engineer may suspend work wholly or in part due to any of the following:

1. Conditions are unsuitable for work progress.
2. You fail to do any of the following:
  - 2.1. Fulfill the Engineer's orders.
  - 2.2. Fulfill a contract part.
  - 2.3. Perform weather-dependent work when conditions are favorable so that weather-related unsuitable conditions are avoided or do not occur.

Upon the Engineer's written order of suspension, suspend work immediately. Provide for public safety and a smooth and unobstructed passageway through the work zone during the suspension as specified in Sections 7-1.08, "Public Convenience," and 7-1.09, "Public Safety." Resume work when ordered.

### **8-1.05B Suspensions Unrelated to Contractor Performance**

For a suspension unrelated to your performance, providing for a smooth and unobstructed passageway through the work during the suspension will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

The days during a suspension unrelated to your performance are non-working days.

### **8-1.05C Suspensions Related to Contractor Performance**

For a suspension related to your performance, the Department may provide for a smooth and unobstructed passageway through the work during the suspension and deduct the cost from payments.

The days during a suspension related to your performance are working days.

## **8-1.06 TIME OF COMPLETION**

The time to complete the work is specified in the special provisions.

The Engineer issues a Weekly Statement of Working Days by the end of the following week unless the contract is suspended for reasons unrelated to your performance.

The Weekly Statement of Working Days shows:

1. Working days and non-working days during the reporting week
2. Time adjustments
3. Work completion date computations, including working days remaining
4. Controlling activities

You may protest a Weekly Statement of Working Days.

## **8-1.07 LIQUIDATED DAMAGES**

### **8-1.07A General**

The Department specifies liquidated damages (Pub Cont Code § 10226). Liquidated damages, if any, accrue starting on the 1st day after the expiration of the working days through the day of contract acceptance except as specified in Sections 8-1.07B, "Failure to Complete Work Parts within Specified Times," and 8-1.07C, "Failure to Complete Work Parts by Specified Dates."

The Department withholds liquidated damages before the accrual date if the anticipated liquidated damages may exceed the value of the remaining work.

Liquidated damages for all work, except plant establishment, are:

Liquidated Damages		
Total Bid		Liquidated Damages per Day
From over	To	
\$0	\$50,000	\$1,200
\$50,000	\$120,000	\$1,500
\$120,000	\$1,000,000	\$1,900
\$1,000,000	\$5,000,000	\$3,000
\$5,000,000	\$10,000,000	\$5,400
\$10,000,000	\$30,000,000	\$8,300
\$30,000,000	\$100,000,000	\$10,500
\$100,000,000	\$250,000,000	\$28,500

If all work, except plant establishment, is complete and the total number of working days has expired, liquidated damages are \$950 per day.

**8-1.07B Failure to Complete Work Parts within Specified Times**

The Department may deduct specified damages from payments for each day in completing a work part beyond the time specified for completing the work part.

Damages for untimely completion of work parts may not be equal to the daily amount specified as liquidated damages for the project as a whole, but the Department does not simultaneously assess damages for untimely completion of work parts and for the whole work.

Damages accrue starting the 1st day after a work part exceeds the specified time through the day the specified work part is complete.

**8-1.07C Failure to Complete Work Parts by Specified Dates**

The Department may deduct specified damages from payments for each day in completing a work part beyond the specified completion date for the work part.

Damages for untimely work part completion may not be equal to the daily amount specified as liquidated damages for the project as a whole, but the Department does not simultaneously assess damages for untimely work part completion and the whole work.

Damages accrue starting the 1st day after an unmet completion date through the day the work part is complete.

**8-1.07D Director Days**

If the work is not completed within the working days, the Director may grant director days if it serves the State's best interest.

By granting director days, the Director adds working days to the contract. The Director may either grant enough days to eliminate the liquidated damages or fewer. In the latter case, the Department deducts liquidated damages for the remaining overrun in contract time. The Director may deduct the Department's engineering, inspection, and overhead costs incurred during the period of extension granted as director days.

**8-1.08 TERMINATION OF CONTROL**

The Department may terminate your control of the work for failure to do any of the following (Pub Cont Code § 10253):

1. Supply an adequate workforce
2. Supply material as described
3. Pay subcontractors (Pub Cont Code §10262)
4. Prosecute the work as described in the contract

The Department may also terminate your control for failure to maintain insurance coverage.

For a Federal-aid contract, the Department may terminate your control of the work for failure to include "Required Contract Provisions, Federal-Aid Construction Contracts" in subcontracts.

The Department gives you and your surety notice at least 5 days before terminating control. The notice describes the failures and the time allowed to remedy the failures. If failures are not remedied within the time provided, the Department takes control of the work.

The Department may complete the work if the Department terminates your control or you abandon the project (Pub Cont Code § 10255). The Department determines the unpaid balance under Pub Cont Code § 10258 and the contract.

At any time before final payment of all claims, the Department may convert a termination of control to a termination of contract.

## **8-1.09 DELAYS**

### **8-1.09A General**

An excusable delay is a delay of a controlling activity beyond your control, not foreseeable when the work began such as:

1. Change in the work
2. Department action that is not part of the contract
3. Presence of an underground utility main not described in the contract or in a location different from that specified
4. Described facility reconstruction not reconstructed as described, by the utility owner by the date specified, unless the reconstruction is solely for your convenience
5. Department's failure to obtain timely access to the right-of-way
6. Department's failure to perform an action in the time specified

A critical delay is a delay that extends the schedule completion date.  
To request a delay-related time or payment adjustment, submit an RFI.

### **8-1.09B Time Adjustments**

For an excusable critical delay, the Department may make a time adjustment. The Engineer uses information from the schedule to evaluate requests for time adjustments.

If requesting an adjustment, submit a revised schedule showing the delay's effect on the controlling activity. If the delay has:

1. Occurred, submit records of dates and what work was performed during the delayed activity
2. Not occurred, submit the expected dates or duration of the delayed activity

If the Engineer requests, update the schedule to the last working day before the start of the delay.

### **8-1.09C Payment Adjustments**

The Department may make a payment adjustment for an excusable delay that affects your costs.

Only losses for idle equipment, idle workers, and equipment moving or transporting are eligible for delay-related payment adjustments.

The Engineer determines payment for idle time of equipment in the same manner as determinations are made for equipment used in the performance of force account work under Section 9-1.03, "Force Account," with the following exceptions:

1. Delay factor in the Labor Surcharge and Equipment Rental Rates applies to each equipment rental rate.
2. Daily number of payable hours equals the normal working hours during the delay, not to exceed 8 hours per day.
3. Delay days exclude non-working days.
4. Markups are not added.

The Engineer determines payment adjustment for idle workers under Section 9-1.03B, "Labor," but does not add markups.

The Engineer includes costs due to necessary extra equipment moving or transporting.

## **8-1.10 (BLANK)**

## **8-1.11 TERMINATION OF CONTRACT**

### **8-1.11A General**

The Director may terminate the contract if it serves the State's best interest. The Department issues you a written notice, implements the termination, and pays you.

### **8-1.11B Relief from Responsibility for Work**

On receiving a termination notice:



**Replace Section 9 with:**

**SECTION 9 MEASUREMENT AND PAYMENT**

**9-1.01 MEASUREMENT OF QUANTITIES**

**9-1.01A General**

The Department determines bid item quantities under U.S. customary units.

**9-1.01B Weighing Equipment and Procedures**

**9-1.01B(1) General**

The Engineer measures material quantities for payment with devices that comply with:

1. 4 CA Code of Regs § 4000 et seq.
2. Bus & Prof Code § 12001 et seq.

To determine the material payment quantities, use measuring devices that have been sealed by the Department of Food and Agriculture's Division of Measurement Standards or its designated representative.

If a device is not type approved by the Division of Measurement Standards, type approve it under California Test 109.

Notify the Engineer at least 1 business day in advance of equipment testing.

Use material plant controllers having elements affecting the data accuracy and delivery that have been sealed by the Engineer. Make these elements available to the Engineer for inspection. If the elements are adequate for use, the Engineer seals them. If security seal manipulation occurs, stop material production. Do not resume production until the Engineer reinspects and reseals the device.

The Engineer measures material paid for by weight on Contractor-furnished sealed scales regularly inspected by the Department of Food and Agriculture's Division of Measurement Standards or its designated representative.

Obtain authorization of portable vehicle scale installations before sealing.

Proportioning scales must comply with Section 5-1.10, "Equipment."

**9-1.01B(2) Equipment**

Each scale must be long enough to fit an entire vehicle or a combination vehicle on the scale deck. The Department allows you to weigh a combination vehicle separately if you disconnect the vehicles.

Construct scale undersupports:

1. Using portland cement concrete containing at least 470 pounds of cement per cubic yard produced from commercial quality materials
2. Such that footing heights are at least 20 inches thick
3. With a bearing surface at least 30 inches wide and bearing pressure on the footing not over 4000 pounds per square foot

In constructing a scale:

1. Furnish drainage to prevent water from saturating the ground under the scale
2. Use bulkheads that prevent displacement
3. If shimming is necessary:
  - 3.1. Use securely attached metal shims or grout
  - 3.2. Do not use wedges to shim the supports
  - 3.3. Do not use shim material in excess of 3 inches
4. Install mechanical indicating elements level, plumb, and rigidly mounted on the concrete undersupports
5. For a hopper scale, rigidly attach hopper scale lever systems and mechanical indicating elements so no weight is lost from bending or support distortion

Each scale used to determine material payment quantities must be operated by a licensed weighmaster (Bus & Prof Code § 12700 et seq.).

Submit a public weighmaster's certificate or certified daily summary weigh sheets for each weighed material quantity. The Department may witness material weighing and check and compile the daily scale weight record.

Each vehicle operator must obtain weight or load slips from the weighmaster. Submit these records at the delivery point.

**9-1.01B(3) Procedures**

Daily, weigh empty vehicles used to haul material paid for by weight. Each vehicle must have a legible identification mark. The Department may verify material weight by having an empty and loaded vehicle weighed on any scale the Engineer designates.

For imported topsoil measured by volume, soil amendment, and mulch:

1. Each vehicle must allow a ready and accurate contents determination
2. Unless vehicles are of uniform capacity, each vehicle must have a legible identification mark showing its volume capacity
3. Load vehicles to at least the volume capacity
4. Level vehicle loads on arrival at the delivery point

If determining a quantity paid on a volume basis is impractical or if you request and the Engineer authorizes the request, the Engineer weighs the material and converts the result to a volume measurement. The Engineer determines the conversion factors and, if you agree, adopts this method of measurement.

**9-1.01C Final Pay Items**

The Department shows a bid item quantity as a final pay item for payment purposes only. For a final pay item, accept payment based on the verified Bid Item List quantity, regardless of actual quantity used unless dimensions are changed by the Engineer.

**9-1.01D Quantities of Aggregate and Other Roadway Materials**

The Engineer determines the weight of aggregate and other roadway materials that are being paid for by weight as shown and does not include the deducted weight of water in their payment quantities.

Material	Quantity Determination
Aggregate or other roadway material except as otherwise shown in this table	By deducting the weight of water in the material <sup>a</sup> in excess of 3 percent of the dry weight of the material from the weight of the material
Imported borrow, imported topsoil, aggregate subbase	By deducting the weight of water in the material <sup>a</sup> in excess of 6 percent of the dry weight of the material from the weight of the material
Straw	By deducting the weight of water in the material <sup>a</sup> in excess of 15 percent of the dry weight of the material from the weight of the material
Fiber <sup>b</sup>	Engineer does not deduct the weight of water
Aggregate base and aggregate for cement treated bases	As specified in Section 26, "Aggregate Bases," and Section 27, "Cement Treated Bases"

NOTE: Percentage of water is determined by California Test 226.

<sup>a</sup>At the time of weighing

<sup>b</sup>Weight of water in the fiber<sup>a</sup> must not exceed 15 percent of the dry weight of the fiber.

**9-1.02 SCOPE OF PAYMENT**

The Department pays you for furnishing the resources and activities required to complete the Contract work. The Department's payment is full compensation for furnishing the resources and activities, including:

1. Risk, loss, damage repair, or cost of whatever character arising from or relating to the work and performance of the work
2. PLACs and taxes

Full compensation for work specified in Sections 1 through 9 is included in the payment for the bid items involved unless:

1. Bid item for the work is shown on the verified Bid Item List
2. Work is specified as paid for as extra work

The Department does not pay for your loss, damage, repair, or extra costs of whatever character arising from or relating to the work that is a direct or indirect result of your choice of construction methods, materials, equipment, or manpower, unless specifically mandated by the Contract.

Payment is:

1. Full compensation for each bid item specified by the description and measurement unit shown on the verified Bid Item List
2. For the price bid for each bid item shown on the verified Bid Item List or as changed by change order with a specified price adjustment

If an alternative is described in the Contract, the Department pays based on the bid items for the details and specifications not described as an alternative.

The Department pays for work performed by change order based on one or a combination of the following:

1. Bid item prices
2. Force account
3. Agreed price
4. Specialist billing

If the Engineer chooses to pay for work performed by change order based on an agreed price, but you and the Engineer cannot agree on the price, the Department pays by force account.

If a portion of extra work is covered by bid items, the Department pays for this work as changed quantities in those items. The Department pays for the remaining portion of the extra work by force account or agreed price.

The Department pays 10 percent annual interest for unpaid and undisputed:

1. Progress payments
2. After-acceptance payment except for claims

For these payments, interest starts to accrue 30 days after the 1st working day following the 20th day of the month payment is due. For extra work bills not submitted within 7 days after performing the work as specified in 5-1.015E, "Extra Work Bills," interest starts to accrue 60 days after the 1st working day following the 20th day of the month payment is due.

The Department pays 6 percent annual interest for unpaid and undisputed claims. Interest starts to accrue 61 days after the Department accepts a claim statement.

The Department pays 6 percent annual interest for awards in arbitration (Civ Code § 3289).

If the amount of a deduction or withhold exceeds final payment, the Department invoices you for the difference, to be paid upon receipt.

### **9-1.03 FORCE ACCOUNT PAYMENT**

#### **9-1.03A General**

For work paid by force account, the Engineer compares the Department's records to your daily force account work report. When you and the Engineer agree on the contents of the daily force account work reports, the Engineer accepts the report and the Department pays for the work. If the records differ, the Department pays for the work based only on the information shown on the Department's records.

If a subcontractor performs work at force account, accept an additional 10 percent markup to the total cost of that work paid at force account, including markups specified in Section 9-1.03, as reimbursement for additional administrative costs.

The markups specified in labor, materials, and equipment include compensation for all delay costs, overhead costs, and profit.

If an item's payment is adjusted for work-character changes, the Department excludes your cost of determining the adjustment.

Payment for owner-operated labor and equipment is made at the market-priced invoice submitted.

#### **9-1.03B Labor**

Labor payment is full compensation for the cost of labor used in the direct performance of the work plus a 35 percent markup. Force account labor payment consists of:

1. Employer payment to the worker for:
  - 1.1. Basic hourly wage

- 1.2. Health and welfare
  - 1.3. Pension
  - 1.4. Vacation
  - 1.5. Training
  - 1.6. Other State and federal recognized fringe benefit payments
2. Labor surcharge percentage in Labor Surcharge and Equipment Rental Rates current during the work paid at force account for:
    - 2.1. Workers' compensation insurance
    - 2.2. Social security
    - 2.3. Medicare
    - 2.4. Federal unemployment insurance
    - 2.5. State unemployment insurance
    - 2.6. State training taxes
  3. Subsistence and travel allowances paid to the workers
  4. Employer payment to supervisors, if authorized

The 35 percent markup consists of payment for all overhead costs related to labor but not designated as costs of labor used in the direct performance of the work including:

1. Home office overhead
2. Field office overhead
3. Bond costs
4. Profit
5. Labor liability insurance
6. Other fixed or administrative costs that are not costs of labor used in the direct performance of the work

### **9-1.03C Materials**

Material payment is full compensation for materials you furnish and use in the work. The Engineer determines the cost based on the material purchase price, including delivery charges, except:

1. A 15 percent markup is added.
2. Supplier discounts are subtracted whether you took them or not.
3. If the Engineer believes the material purchase prices are excessive, the Department pays the lowest current wholesale price for a similar material quantity.
4. If you procured the materials from a source you wholly or partially own, the determined cost is based on the lower of the:
  - 4.1. Price paid by the purchaser for similar materials from that source on Contract items
  - 4.2. Current wholesale price for those materials
5. If you do not submit a material cost record within 30 days of billing, the determined cost is based on the lowest wholesale price:
  - 5.1. During that period
  - 5.2. In the quantities used

### **9-1.03D Equipment Rental**

#### **9-1.03D(1) General**

Equipment rental payment is full compensation for:

1. Rental equipment costs, including moving rental equipment to and from the site of work performed by change order using its own power.
2. Transport equipment costs for rental equipment that cannot be transported economically using its own power. No payment is made during transport for the transported equipment.
3. 15 percent markup.

If you want to return the equipment to a location other than its original location, the payment to move the equipment must not exceed the cost of returning the equipment to its original location. If you use the equipment for work other than work paid by force account, the transportation cost is included in the other work.

Before moving or loading the equipment, obtain authorization for the equipment rental's original location.

The Engineer determines rental costs:

1. Using rates in Labor Surcharge and Equipment Rental Rates:
  - 1.1. By classifying equipment using manufacturer's ratings and manufacturer-approved changes.
  - 1.2. Current during the work paid by force account.
  - 1.3. Regardless of equipment ownership; but the Department uses the rental document rates or minimum rental cost terms if:
    - 1.3.1. Rented from equipment business you do not own.
    - 1.3.2. The Labor Surcharge and Equipment Rental Rates hourly rate is \$10.00 per hour or less.
2. Using rates established by the Engineer for equipment not listed in Labor Surcharge and Equipment Rental Rates. You may submit cost information that helps the Engineer establish the rental rate; but the Department uses the rental document rates or minimum rental cost terms if:
  - 2.1. Rented from equipment business you do not own.
  - 2.2. The Engineer establishes a rate of \$10.00 per hour or less.
3. Using rates for transport equipment not exceeding the hourly rates charged by established haulers.

Equipment rental rates include the cost of:

1. Fuel
2. Oil
3. Lubrication
4. Supplies
5. Small tools that are not consumed by use
6. Necessary attachments
7. Repairs and maintenance
8. Depreciation
9. Storage
10. Insurance
11. Incidentals

The Department pays for small tools consumed by use. The Engineer determines payment for small tools consumed by use based on Contractor-submitted invoices.

#### **9-1.03D(2) Equipment On the Job Site**

For equipment on the job site at the time required to perform work paid by force account, the time paid is the time:

1. To move the equipment to the location of work paid by force account plus an equal amount of time to move the equipment to another location on the job site when the work paid by force account is completed
2. To load and unload equipment
3. Equipment is operated to perform work paid by force account and:
  - 3.1. Hourly rates are paid in 1/2-hour increments
  - 3.2. Daily rates are paid in 1/2-day increments

When rented equipment on the job site is used to perform work at force account not required by the original contract work, the Engineer may authorize rates in excess of those in Labor Surcharge and Equipment Rental Rates if:

1. You submit a request to use rented equipment
2. Equipment is not available from your owned equipment fleet or from your subcontractors

3. Rented equipment is from an independent rental company
4. Proposed equipment rental rate is reasonable
5. Engineer authorizes the equipment source and the rental rate before you use the equipment

The Department pays for fuel consumed during operation of rented equipment not included in the invoiced rental rate.

**9-1.03D(3) Equipment Not On the Job Site Required for Original Contract Work**

For equipment not on the job site at the time required to perform work paid by force account and required for original Contract work, the time paid is the time the equipment is operated to perform work paid by force account and the time to move the equipment to a location on the job site when the work paid by force account is completed.

The minimum total time paid is:

1. 1 day if daily rates are paid
2. 8 hours if hourly rates are paid

If daily rates are recorded, equipment:

1. Idled is paid as 1/2 day
2. Operated 4 hours or less is paid as 1/2 day
3. Operated 4 hours or more is paid as 1 day

If the minimum total time exceeds 8 hours and if hourly rates are listed, the Department rounds up hours operated to the nearest 1/2-hour increment and pays based on the following table. The table does not apply when equipment is not operated due to breakdowns; in which case rental hours are the hours the equipment was operated.

**Equipment Rental Hours**

Hours operated	Hours paid
0.0	4.00
0.5	4.25
1.0	4.50
1.5	4.75
2.0	5.00
2.5	5.25
3.0	5.50
3.5	5.75
4.0	6.00
4.5	6.25
5.0	6.50
5.5	6.75
6.0	7.00
6.5	7.25
7.0	7.5
7.5	7.75
>8.0	hours used

**9-1.03D(4) Equipment Not On the Job Site Not Required for Original Contract Work**

For equipment not on the job site at the time required to perform work paid by force account and not required for original Contract work, the time paid is the time:

1. To move the equipment to the location of work paid by force account plus an equal amount of time to return the equipment to its source when the work paid by force account is completed
2. To load and unload equipment
3. Equipment is operated to perform work paid by force account

For this equipment, the Engineer may authorize rates in excess of those in Labor Surcharge and Equipment Rental Rates subject to the following:

1. Equipment is not available from your normal sources or from one of your subcontractors

2. Proposed equipment rental rate is reasonable
3. Engineer authorizes the equipment source and the rental rate before you use the equipment

#### **9-1.03D(5) Non-Owner-Operated Dump Truck Rental**

Submit the rental rate for non-owner-operated dump truck rental. The Engineer determines the payment rate. Payment for non-owner-operated dump truck rental is for the cost of renting a dump truck, including its driver. For the purpose of markup payment only, the non-owner-operated dump truck is rental equipment and the owner is a subcontractor.

#### **9-1.04 EXTRA WORK PERFORMED BY SPECIALISTS**

If the Engineer determines that you or your subcontractors are not capable of performing specialty extra work, a specialist may be used. Itemize the labor, material, and equipment rental costs unless it is not the special service industry's established practice to provide itemization; in which case, the Engineer accepts current market-priced invoices for the work.

The Engineer may accept an invoice as a specialist billing for work performed at an off-job site manufacturing plant or machine shop.

The Engineer determines the cost based on the specialist invoice price minus any available or offered discounts plus a 10 percent markup.

#### **9-1.05 CHANGED QUANTITY PAYMENT ADJUSTMENTS**

##### **9-1.05A General**

The unit prices specified in Section 9-1.05 are adjusted under Section 9-1.03, "Force Account."

##### **9-1.05B Increases of More Than 25 Percent**

If the total bid item quantity exceeds 125 percent of the quantity shown on the verified Bid Item List and if no approved Contract Change Order addresses payment for the quantity exceeding 125 percent, the Engineer may adjust the unit price for the excess quantity under Section 9-1.03, "Force Account," or the following:

1. The adjustment is the difference between the unit price and the unit cost of the total item pay quantity.
2. In determining the unit cost, the Engineer excludes the item's fixed costs. You have recovered the fixed costs in the payment for 125 percent shown on the verified Bid Item List.
3. After excluding fixed costs, the Engineer determines the item unit cost under Section 9-1.03, "Force Account."

If the payment for the number of units of a bid item in excess of 125 percent of the verified Bid Item List is less than \$5,000 at the unit price, the Engineer may not adjust the unit price unless you request it.

##### **9-1.05C Decreases of More Than 25 Percent**

If the total item pay quantity is less than 75 percent of the quantity shown on the verified Bid Item List and if no approved Contract Change Order addresses payment for the quantity less than 75 percent, you may request a unit price adjustment. The Engineer may adjust the unit price for the decreased quantity under Section 9-1.03, "Force Account" or the following:

1. The adjustment is the difference between the unit price and the unit cost of the total pay quantity.
2. In determining the unit cost, the Engineer includes the item's fixed costs.
3. After including fixed costs, the Engineer determines the item unit cost under Section 9-1.03, "Force Account."

The Department does not pay more than 75 percent of the item total in the verified Bid Item List.

##### **9-1.05D Eliminated Items**

If the Engineer eliminates an item, the Department pays your costs incurred before the Engineer's elimination notification date.

If you order authorized material for an eliminated item before the notification date and the order cannot be canceled, either of the following occurs:

1. If the material is returnable to the vendor, the Engineer orders you to return the material and the Department pays your handling costs and vendor charges.
2. The Department pays your cost for the material and its handling and becomes the material owner.

The Engineer determines the payment for the eliminated bid item under Section 9-1.03, "Force Account."

### **9-1.06 WORK-CHARACTER CHANGES**

The Department adjusts a bid item unit price based on the difference between the cost to perform the work as planned and the cost to perform the work as changed. The Engineer determines the payment adjustment under Section 9-1.03, "Force Account." The Department adjusts payment for only the work portion that changed in character.

### **9-1.07 PROGRESS PAYMENTS**

#### **9-1.07A General**

The Department pays you based on Engineer-prepared monthly progress estimates. Each estimate reflects:

1. Total work completed during the pay period
2. Extra work bills if:
  - 2.1. Submitted by the 15th of a month
  - 2.2. Approved by the 20th of a month
3. Amount for materials on hand
4. Amount earned for mobilization
5. Deductions
6. Withholds
7. Resolved potential claims
8. Payment adjustments

Submit certification stating the work complies with the QC procedures. The Engineer does not process a progress estimate without a signed certification.

You may protest a progress payment.

#### **9-1.07B Schedule of Values**

Section 9-1.07B applies to a lump sum bid item for which a schedule of values is specified to be submitted.

The sum of the amounts for the work units listed in the schedule of values must equal the lump sum price bid for the bid item.

Obtain authorization of a schedule of values before you perform work shown on the schedule. The Department does not process a progress payment for the bid item without an authorized schedule of values.

Accept progress payments for overhead, profit, bond costs, and other fixed or administrative costs as distributed proportionally among the items listed except that for a contract with a bid item for mobilization, accept progress payments for bond costs as included in the mobilization bid item.

For changed quantities of the work units listed, the Department adjusts payments in the same manner as specified for changed quantities of bid items under Section 9-1.05, "Changed Quantity Payment Adjustments."

#### **9-1.07C Materials On Hand**

A material on hand but not incorporated into the work is eligible for progress payment if:

1. Listed in a special provision as eligible and is in compliance with other Contract parts
2. Purchased
3. An invoice is submitted
4. Stored within the State and you submit evidence that the stored material is subject to the Department's control
5. Requested on the Department-furnished form

#### **9-1.07D Mobilization**

Mobilization is eligible for partial payments if the Contract includes a bid item for mobilization. The Department makes the partial payments under Pub Cont Code § 10264. If the Contract does not include a mobilization bid item, mobilization is included in the payment for the various bid items.

The Department pays the item total for mobilization in excess of 10 percent of the total bid in the 1st payment after Contract acceptance.

#### **9-1.07E Withholds**

##### **9-1.07E(1) General**

The Department may withhold payment for noncompliance.

The Department returns the noncompliance withhold in the progress payment following correction of noncompliance.

Withholds are not retentions under Pub Cont Code § 7107 and do not accrue interest under Pub Cont Code § 10261.5.

Withholds are cumulative and independent of deductions.

Section 9-1.07E does not include all withholds that may be taken; the Department may withhold other payments as specified.

#### **9-1.07E(2) Progress Withholds**

The Department withholds 10 percent of a partial payment for noncompliant progress. Noncompliant progress occurs when:

1. Total days to date exceed 75 percent of the revised Contract working days
2. Percent of working days elapsed exceeds the percent of value of work completed by more than 15 percent

The Engineer determines the percent of working days elapsed by dividing the total days to date by the revised Contract working days and converting the quotient to a percentage.

The Engineer determines the percent of value of work completed by summing payments made to date and the amount due on the current progress estimate, dividing this sum by the current total estimated value of the work, and converting the quotient to a percentage. These amounts are shown on the Progress Payment Voucher.

When the percent of working days elapsed minus the percent of value of work completed is less than or equal to 15 percent, the Department returns the withhold in the next progress payment.

#### **9-1.07E(3) Performance Failure Withholds**

During each estimate period you fail to comply with a Contract part, including submittal of a document as specified, the Department withholds a part of the progress payment. The documents include QC plans, schedules, traffic control plans, and water pollution control submittals.

For 1 performance failure, the Department withholds 25 percent of the progress payment but does not withhold more than 10 percent of the total bid.

For multiple performance failures, the Department withholds 100 percent of the progress payment but does not withhold more than 10 percent of the total bid.

#### **9-1.07E(4) Stop Notice Withholds**

The Department may withhold payments to cover claims filed under Civ Code § 3179 et seq.

Stop notice information may be obtained from the Office of External Accounts Payable, Division of Accounting.

#### **9-1.07E(5) Penalty Withholds**

Penalties include fines and damages that are proposed, assessed, or levied against you or the Department by a governmental agency or private lawsuit. Penalties are also payments made or costs incurred in settling alleged violations of federal, state, or local laws, regulations, requirements, or PLACs. The cost incurred may include the amount spent for mitigation or correcting a violation.

If you or the Department is assessed a penalty, the Department may withhold the penalty amount until the penalty disposition has been resolved. The Department may withhold penalty funds without notifying you.

Instead of the withhold, you may provide a bond equal to the highest estimated liability for any disputed penalties proposed.

#### **9-1.07E(6)–9-1.07E(10) Reserved**

#### **9-1.07F Retentions**

The Department does not retain moneys from progress payments due to the Contractor for work performed (Pub Cont Code § 7202).

#### **9-1.07G–9-1.07K Reserved**

### **9-1.08 PAYMENT AFTER CONTRACT ACCEPTANCE**

#### **9-1.08A General**

Reserved

### **9-1.08B Payment Before Final Estimate**

After Contract acceptance, the Department pays you based on the Engineer-prepared estimate that includes withholds and the balance due after deduction of previous payments.

### **9-1.08C Proposed Final Estimate**

The Engineer estimates the amount of work completed and shows the amount payable in a proposed final estimate based on:

1. Contract items
2. Payment adjustments
3. Work paid by force account or agreed price
4. Extra work
5. Deductions

Submit either a written final estimate acceptance or a claim statement no later than the 30th day after receiving the proposed final estimate. Evidence of the Contractor's receipt of the final estimate and the Engineer's receipt of the Contractor's written acceptance or claim statement is a delivery service's proof of delivery or Engineer's written receipt if hand delivered.

If you claim that the final estimate is less than 90 percent of your total bid, the Department adjusts the final payment to cover your overhead. The adjustment is 10 percent of the difference between the total bid and the final estimate. The Department does not make this adjustment on a terminated contract.

### **9-1.08D Final Payment and Claims**

#### **9-1.08D(1) General**

If you accept the proposed final estimate or do not submit a claim statement within 30 days of receiving the estimate, the Engineer furnishes the final estimate to you and the Department pays the amount due within 30 days. This final estimate and payment is conclusive except as specified in Sections 5-1.015, "Records," 6-1.075, "Guarantee," and 9-1.09, "Clerical Errors."

If you submit a claim statement within 30 days of receiving the Engineer's proposed final estimate, the Engineer furnishes a semifinal estimate to the Contractor and the Department pays the amount due within 30 days. The semifinal estimate is conclusive as to the amount of work completed and the amount payable except as affected by the claims or as specified in Sections 5-1.015, "Records," 6-1.075, "Guarantee," and 9-1.09, "Clerical Errors."

#### **9-1.08D(2) Claim Statement**

##### **9-1.08D(2)(a) General**

For each claim, submit a claim statement showing only the identification number that corresponds to the Full and Final Potential Claim Record and the final amount of additional payment requested except:

1. If the final amount of requested payment differs from the amount requested in the Full and Final Potential Claim Record
2. For a claim for quantities, withholds, deductions, liquidated damages, or change order bills
3. For an overhead claim

If the final amount of requested payment differs from the amount requested in the Full and Final Potential Claim Record, submit:

1. Identification number that corresponds to the Full and Final Potential Claim Record
2. Final amount of additional payment requested
3. Basis for the changed amount
4. Contract documentation that supports the changed amount
5. Statement of the reasons the Contract documentation supports the claim

The Engineer notifies you of an omission of or a disparity in the exclusive identification number. Within 15 days of the notification, correct the omission or disparity. If the omission or disparity is not resolved after the 15 days, the Engineer assigns a new number.

For a claim for quantities, withholds, deductions, or change order bills submit:

1. Final amount of additional payment requested

2. Enough detail to enable the Engineer to determine the basis and amounts of the additional payment requested

### **9-1.08D(2)(b) Overhead Claims**

Include with an overhead claim:

1. Final amount of additional payment requested
2. Independent CPA audit report

Failure to submit the audit report with an overhead claim with the claim statement is a waiver of the overhead claim and operates as a bar to arbitration on the claim (Pub Cont Code § 10240.2).

The Department deducts an amount for field and home office overhead paid on added work from any claim for overhead. The value of the added work equals the value of the work completed minus the total bid. The home office overhead deduction equals 5 percent of the added work. The field office overhead deduction equals 5-1/2 percent of the added work.

If you intend to pursue a claim for reimbursement for field or home office overhead beyond that provided expressly by the Contract:

1. Notify the Engineer within 30 days of receipt of the proposed final estimate of your intent to seek reimbursement for specific overhead costs beyond that provided by the Contract
2. Specifically identify each claim and each date associated with each claim from which you seek reimbursement for specific overhead costs beyond that provided by the Contract
3. Timely submit all other claims
4. Within 30 days of receipt of the proposed final estimate, submit an audit report prepared by an independent CPA
  - 4.1. The audit report must show calculations with supporting documentation of actual home office and project field overhead costs
  - 4.2. The calculations must specify the actual daily rates for both field and home office overhead for the entire duration of the project expressed as a rate per working day
  - 4.3. The start and end dates of the actual project performance period, number of working days, overhead cost pools, and all allocation bases must be disclosed in the calculations of your actual field and home office overhead daily rates
  - 4.4. Neither daily rate may include a markup for profit
5. Field overhead costs from which the daily rate is calculated must be:
  - 5.1. Allowable under 48 CFR 31
  - 5.2. Supported by reliable records
  - 5.3. Related solely to the project
  - 5.4. Incurred during the actual project performance period
  - 5.5. Comprised of only time-related field overhead costs
  - 5.6. Not a direct cost
6. Home office overhead costs from which the daily rate is calculated must be:
  - 6.1. Allowable under 48 CFR 31
  - 6.2. Supported by reliable records
  - 6.3. Incurred during the actual project performance period
  - 6.4. Comprised of only fixed home office overhead costs
  - 6.5. Not a direct cost

The actual rate of time-related overhead is subject to authorization by the Engineer.

The CPA's audit must be performed under the Attestation Standards published by the American Institute of Certified Public Accountants. The CPA's audit report must express an opinion whether or not your calculations of your actual field and home office overhead daily rates comply with Section 9-1.08D(2)(b), "Overhead Claims." The attest documentation prepared by the CPA in connection with the audit must be reproduced and submitted for review with the audit report.

The Department provides markups for all work paid by force account. Overhead for field and home office costs are included in the markups. Overhead claims in excess of Contract markups are not allowed under the Contract. If you seek reimbursement for costs not allowed under the Contract, the Department does not pay your cost of performing the independent CPA examination specified in section 9-1.08D(2)(b), "Overhead Claims," including preparation of the audit report.





**Replace Section 14 with:**  
**SECTION 14 ENVIRONMENTAL STEWARDSHIP**  
**14-1 GENERAL**

**14-1.01 GENERAL**

Environmental stewardship includes both environmental compliance and environmental resource management. If an ESA is shown on the plans:

1. The boundaries shown are approximate; the Department marks the exact boundaries on the ground
2. Do not enter the ESA unless authorized
3. If the ESA is breached, immediately:
  - 3.1. Secure the area and stop all operations within 60 feet of the ESA boundary
  - 3.2. Notify the Engineer
4. If the ESA is damaged, the Department determines what efforts are necessary to remedy the damage and who performs the remedy; you are responsible for remedies and charges.

**14-2 CULTURAL RESOURCES**

**14-2.01 GENERAL**

Reserved

**14-2.02 ARCHAEOLOGICAL RESOURCES**

If archaeological resources are discovered at the job site, do not disturb the resources and immediately:

1. Stop all work within a 60-foot radius of the discovery
2. Protect the discovery area
3. Notify the Engineer

The Department investigates. Do not move archaeological resources or take them from the job site. Do not resume work within the discovery area until authorized.

If, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of an archaeological find, or investigation or recovery of archeological materials, you will be compensated for resulting losses, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays."

If ordered, furnish resources to assist in the investigation or recovery of archaeological resources. This work will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

**14-2.03 ARCHAEOLOGICAL MONITORING AREA**

Section 14-2.03 applies if an AMA is described in the Contract.

The Department assigns an archaeological monitor to monitor job site activities within the AMA. Do not work within the AMA unless the archeological monitor is present.

The Engineer and the Department archaeological monitor conduct an AMA location field review with you at least 5 business days before start of work. The Department marks the exact boundaries of the AMA on the ground.

If temporary fence (Type ESA) or other enclosure for an AMA is described in the Contract, install temporary fence (Type ESA) or other enclosure to define the boundaries of the AMA during the AMA location field review.

At least 5 business days before starting work within an AMA, submit a schedule of days and hours to be worked for the Engineer's approval. If you require changes in the schedule, submit an update for the Engineer's approval at least 5 business days before any changed work day.

If archaeological resources are discovered within an AMA, comply with Section 14-2.02, "Archaeological Resources."

**14-2.04 HISTORIC STRUCTURES**

Reserved

**14-3 COMMUNITY IMPACTS AND ENVIRONMENTAL JUSTICE**

Reserved

**14-4 NATIVE AMERICAN CONCERNS**

Reserved

## 14-5 AESTHETICS

Reserved

## 14-6 BIOLOGICAL RESOURCES

### 14-6.01 GENERAL

Reserved

### 14-6.02 BIRD PROTECTION

Protect migratory and nongame birds, their occupied nests, and their eggs.

The Department anticipates nesting or attempted nesting from February 15 to September 1.

The federal Migratory Bird Treaty Act, 16 USC § 703–711, and 50 CFR Pt 10 and Fish & Game Code §§ 3503, 3513, and 3800 protect migratory and nongame birds, their occupied nests, and their eggs.

The federal Endangered Species Act of 1973, 16 USC §§ 1531 and 1543, and the California Endangered Species Act, Fish & Game Code §§ 2050–2115.5, prohibit the take of listed species and protect occupied and unoccupied nests of threatened and endangered bird species.

The Bald and Golden Eagle Protection Act, 16 USC § 668, prohibits the destruction of bald and golden eagles and their occupied and unoccupied nests.

If migratory or nongame bird nests are discovered that may be adversely affected by construction activities or an injured or killed bird is found, immediately:

1. Stop all work within a 100-foot radius of the discovery.
2. Notify the Engineer.

The Department investigates. Do not resume work within the specified radius of the discovery until authorized.

When ordered, use exclusion devices, take nesting prevention measures, remove and dispose of partially constructed and unoccupied nests of migratory or nongame birds on a regular basis to prevent their occupation, or perform any combination of these. This work will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

Prevent nest materials from falling into waterways.

Bird protection that causes a delay to the controlling activity is a condition unfavorable to the suitable prosecution of work as specified in Section 8-1.05, "Temporary Suspension of Work."

## 14-7 PALEONTOLOGICAL RESOURCES

If paleontological resources are discovered at the job site, do not disturb the material and immediately:

1. Stop all work within a 60-foot radius of the discovery
2. Protect the area
3. Notify the Engineer

The Department investigates and modifies the dimensions of the protected area if necessary. Do not move paleontological resources or take them from the job site. Do not resume work within the specified radius of the discovery until authorized.

## 14-8 NOISE AND VIBRATION

### 14-8.01 GENERAL

Reserved

### 14-8.02 NOISE CONTROL

Do not exceed 86 dBA LMax at 50 feet from the job site activities from 9 p.m. to 6 a.m.

Equip an internal combustion engine with the manufacturer-recommended muffler. Do not operate an internal combustion engine on the job site without the appropriate muffler.

## 14-9 AIR QUALITY

### 14-9.01 AIR POLLUTION CONTROL

Comply with air pollution control rules, regulations, ordinances, and statutes that apply to work performed under the Contract, including air pollution control rules, regulations, ordinances, and statutes provided in Govt Code § 11017 (Pub Cont Code § 10231).

Do not burn material to be disposed of.





## SECTION 20 EROSION CONTROL AND HIGHWAY PLANTING

(Issued 08-17-07)

### Replace Section 20-2.03 with:

#### 20-2.03 SOIL AMENDMENT

Soil amendment shall comply with the requirements in the California Food and Agricultural Code. Soil amendment producers shall comply with the following:

1. Be fully permitted to produce compost as specified under the California Integrated Waste Management Board, Local Enforcement Agencies and any other State and Local Agencies that regulate Solid Waste Facilities. If exempt from State permitting requirements, the composting facility must certify that it follows guidelines and procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.
2. Be a participant in United States Composting Council's Seal of Testing Assurance program.

Soil amendment shall be composted and may be derived from any single, or mixture of any of the following feedstock materials:

1. Green material consisting of chipped, shredded, or ground vegetation; or clean processed recycled wood products
2. Biosolids
3. Manure
4. Mixed food waste

Soil amendment feedstock materials shall be composted to reduce weed seeds, pathogens and deleterious materials as specified under Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7, Section 17868.3.

Soil amendment shall not be derived from mixed municipal solid waste and must be reasonably free of visible contaminants. Soil amendment must not contain paint, petroleum products, pesticides or any other chemical residues harmful to animal life or plant growth. Soil amendment must not possess objectionable odors.

Metal concentrations in soil amendment must not exceed the maximum metal concentrations listed in Title 14, California Code of Regulations, Division 7, Chapter 3.1, Section 17868.2.

Soil amendment must comply with the following:



## SECTION 24 LIME STABILIZATION

(Issued 06-05-09)

Replace Section 24 with:

### SECTION 24 LIME STABILIZED SOIL

#### 24-1.01 GENERAL

##### 24-1.01A Summary

Section 24 includes specifications for stabilizing soil by mixing lime and water with soil and compacting the mixture to the specified dimensions.

##### 24-1.01B Definitions

**lime:** Quicklime made from high-calcium or dolomitic sources specified under ASTM C 51. For high-calcium quicklime, the calcium oxide content must be greater than 90 percent. For dolomitic quicklime, the calcium oxide content must be greater than 55 percent and the combined calcium oxide and magnesium oxide content must be greater than 90 percent.

**mellowing period:** The time between the initial and final mixing to promote initial chemical reactions between lime, water, and soil.

##### 24-1.01C Submittals

From 30 to 180 days before use, submit one 10-pound sample of each lime product proposed and from each source.

Submit lime samples in airtight containers under ASTM C 50. Mark the sample date on the container. Include the MSDS and chemical and physical analysis with the submittal.

With the lime samples, submit a Certificate of Compliance from the pre-qualified lime source under Section 6-1.07, "Certificates of Compliance," with a statement certifying the lime furnished is the same as that pre-qualified.

Fifteen days before starting soil stabilization activities, submit for the Engineer's approval a laboratory to perform quality control tests. The laboratory must be qualified under the Department's Independent Assurance Program.

Before you apply lime in slurry form, submit the slurry's lime content for Engineer's approval 25 days before application.

Before performing quality control sampling and testing, submit the time and location the sampling and testing will occur. Submit quality control testing results within 24 hours of receiving the results.

Submit a weighmaster certificate or bill of lading with each load of lime delivered to the jobsite.

##### 24-1.01D Quality Control and Assurance

###### General

Perform quality control testing in the presence of the Engineer.

Place unique, sequentially numbered lock seals on each load and affix them to trailer blow down valves that are locked open. The bill of lading for each lime delivery must have that specific lock seal number legibly and visibly imprinted.

The Engineer samples each lime delivery truck at the job site and randomly tests them off-site.

###### Pre-qualification of Lime Sources

Lime sources must be listed on the Department's pre-qualified products list. The list is available at the METS web site.

The pre-qualified list for lime sources describes the application procedures for inclusion on the list.

###### Preparing Soil

After you prepare an area for lime soil stabilization, test the soil to be stabilized every 500 cubic yards for relative compaction under California Test 231 and moisture content under California Test 226, and verify the surface grades.

###### Applying Lime

The Engineer determines the final application rate for each lime product proposed from the samples submitted. If the soil being stabilized changes, the Engineer changes the application rate. Based on California Test 373, the Engineer reports the application rates as the percent of lime by dry weight of soil. The Engineer provides the optimum moisture content determined under California Test 373 for each application rate.

Before applying lime, measure the temperature at the ground surface.

If lime in dry form is used, the Engineer verifies the application rate using the drop pan method once per 40,000 square feet stabilized, or twice per day, whichever is greater.

If lime in slurry form is used, report the quantity of slurry placed by measuring the volume of slurry in the holding tank once per 40,000 square feet stabilized, or twice per day, whichever is greater.

### **Mixing**

For each day of initial mixing, test the moisture content. Sample the material immediately after initial mixing.

Randomly test the adequacy of the final mixing with a phenolphthalein indicator solution.

During mixing operations, measure the ground temperature at full mixing depth.

After mixing and before compacting, determine maximum density under California Test 216 from composite samples of the mixed material and at each distinct change in material. Test the moisture content of the mixed material under California Test 226. Test the gradation for compliance with "Materials."

### **Compaction**

Test relative compaction on a wet weight basis.

After initial compaction, determine in-place density under California Test 231 and moisture content under California Test 226 at the same locations. The testing frequency must be 1 test per 250 cubic yards of lime stabilized soil. Test in 0.50-foot depth intervals.

Before requesting to compact material in layers greater than 0.50 foot, construct a test strip in the production area and demonstrate the test strip passes compaction tests using the proposed thickness. The test strip must contain no more material than 1 day's production. The Engineer tests at not more than 0.50-foot depth intervals regardless of the thickness of your layers.

Construct test pads by scraping away material to the depth ordered by the Engineer. If a compaction test fails corrective action must include the layers of material already placed above the test pad elevation.

### **Finish Grading**

Do not proceed with construction activities for subsequent layers of material until the Engineer verifies the final grades of the lime stabilized soil.

### **Dispute Resolution**

You and the Engineer must work together to avoid potential conflicts and to resolve disputes regarding test result discrepancies. Notify the Engineer within 5 days of receiving a test result if you dispute the test result.

If you or the Engineer dispute each other's test results, submit written quality control test results and copies of paperwork including worksheets used to determine the disputed test results to the Engineer. An Independent Third Party (ITP) performs referee testing. Before the ITP participates in a dispute resolution, the ITP must be accredited under the Department's Independent Assurance Program. The ITP must be independent of the project. By mutual agreement, the ITP is chosen from:

1. A Department laboratory
2. A Department laboratory in a district or region not in the district or region the project is located
3. The Transportation Laboratory
4. A laboratory not currently employed by you or your lime producer

If split quality control or acceptance samples are not available, the ITP uses any available material representing the disputed material for evaluation.

## **24-1.02 MATERIALS**

### **24-1.02A Lime**

Lime must comply with ASTM C 977 and the following:

<b>Lime</b>		
Quality Characteristic	ASTM	Specification
Available Calcium and Magnesium Oxide(min., %)	C 25 <sup>a</sup>	High Calcium Quicklime: CaO > 90 Dolomitic Quicklime: CaO > 55 and CaO + MgO > 90
Loss on ignition (max., %)	C 25	7 (total loss) 5 (carbon dioxide) 2 (free moisture)
Slaking rate	C 110	30 °C rise in 8 minutes

Notes:

<sup>a</sup> You may use ASTM C25 or ASTM C1301 and ASTM C1271.

A 0.5-pound sample of lime dry-sieved in a mechanical sieve shaker for 10 minutes ±30 seconds must comply with:

Sieve Sizes	Percentage Passing
3/8-inch	98-100

Slurry must:

1. Be free of contaminants
2. Contain at least the minimum dry solids
3. Have uniform consistency

If you prepare lime slurry, prepare it at the jobsite.

#### **24-1.02B Water**

If available, use potable water. Inform the Engineer if a water source other than potable water is used. If not using potable water, water for mixing soil and lime must:

1. Contain no more than 650 parts per million of chlorides as Cl, and no more than 1,300 parts per million of sulfates as SO<sub>4</sub>
2. Not contain an amount of impurities that will cause a reduction in the strength of the stabilize soil

#### **24-1.02C Mixed Material**

Take a composite sample from 5 random locations after initial mixing. The moisture content of the composite sample tested under California Test 226 must be a minimum of 3 percent greater than optimum. Determine the moisture versus density relationship of the composite sample material determined under California Test 216, except Part 2, Section E, Paragraph 6 is modified as follows:

After adjustment of the moisture content, compact each of the remaining test specimens in the mold, then record the water adjustment, tamper reading, and the corresponding adjusted wet density from the chart on Table 1 using the column corresponding to the actual wet weight of the test specimen compacted. Note each of these wet weights on Line I.

The mixed material before compaction excluding rock must comply with:

Sieve Sizes	Percentage Passing
1"	98 - 100
No. 4	60 - 100

#### **24-1.02D Curing Treatment**

Curing treatment may be any of the following:

1. Water cure
2. Curing seal
3. Moist material blanket

Curing seal must be SS or CSS grade asphaltic emulsion under Section 94, "Asphaltic Emulsions."

### **24-1.03 CONSTRUCTION**

#### **24-1.03A General**

If using different types of lime or lime from more than one source, do not mix them. The Engineer determines separate application rates.

Deliver lime in full loads unless it is the last load needed for a work shift.

Apply lime at ground temperatures above 35 °F. Do not apply lime if you expect the ground temperature to drop below 35 °F before you complete mixing and compacting.

During mixing, maintain the in-place moisture of the soil to be stabilized a minimum 3 percent above the optimum moisture determined under California Test 216 as modified in "Mixed Material." During compaction and finish grading, add water to the surface to prevent drying until the next layer of mixed material is placed, or until you apply curing treatment.

Scarify the surface of lime stabilized soil at least 2 inches between each layer. Do not scarify the final surface of the lime stabilized soil.

Between the time of applying lime and 3 days after applying curing treatment, only allow equipment or vehicles on the soil being stabilized that are essential to the work.

#### **24-1.03B Preparing Soil**

Except for soil clods, remove rocks or solids larger than 1/3 of the layer thickness. Regardless of the layer thickness, remove rocks and solids greater than 4 inches. Notify the Engineer if you encounter rocks or solids greater than 1/3 of the layer thickness.

Before adding lime, place the soil to be stabilized to within 0.08 foot of the specified lines and grades and compact to not less than 90 percent relative compaction.

#### **24-1.03C Applying Lime**

Apply lime uniformly over the area to be stabilized using a vane spreader.

The Engineer determines the final application rate. Do not vary from this application rate by more than 5 percent.

Apply lime in dry form. If you request and the Engineer approves, you may apply lime in slurry form.

Lime slurry must be in suspension during application. Apply lime slurry uniformly making successive passes over a measured section or roadway until the specified lime content is reached. Apply the residue from lime slurry over the length of the roadway being processed.

#### **24-1.03D Mixing**

Lime and soil to be stabilized must be mixed uniformly at least twice to within 0.10 foot of the specified depth at any point. If the mixing depth exceeds the specified depth by more than 10 percent, add lime in proportion to the exceeded depth. The Department does not pay for this added lime.

Mix lime on the same day it is applied. After the initial mixing, allow a mellowing period for at least 36 hours before final mixing. Moisture content during the mellowing period determined under California Test 226 must be at least 3 percent higher than the optimum moisture content. You may add water and mix during the mellowing period.

Remix until the mixture is uniform with no streaks or pockets of lime.

Except for clods larger than 1 inch, mixed material must have a color reaction with sprayed phenolphthalein alcohol indicator solution.

Complete all the mixing work within 7 days of the initial application of lime.

### **24-1.03E Compaction**

Begin compacting immediately after final mixing, but not less than 36 hours after the beginning of initial mixing.

Compact by using sheepsfoot or segmented wheel rollers immediately followed by steel drum or pneumatic-tired rollers. Do not use vibratory rollers.

If you request and the Engineer approves, you may compact mixed material in layers greater than 0.50 foot.

If the specified thickness is 0.50 foot or less, compact in one layer. If the specified thickness is more than 0.50 foot, compact in 2 or more layers of approximately equal thickness. The maximum compacted thickness of any one layer must not exceed 0.50 foot unless you first demonstrate your equipment and methods provide uniform distribution of lime and achieve the specified compaction.

Use other compaction methods in areas inaccessible to rollers.

Compact the lime stabilized soil to at least 95 percent relative compaction determined under California Test 216 as modified under "Mixed Material." The relative compaction is determined on a wet weight basis.

### **24-1.03F Finish Grading**

Maintain the moisture content of the lime stabilized soil through the entire finish grading operation at a minimum of 3 percent above optimum moisture content.

The finished surface of the lime stabilized soil must not vary more than 0.08 foot above or below the grade established by the Engineer unless the lime stabilized soil is to be covered by material paid for by the cubic yard, in which case the finished surface may not vary above the grade established by the Engineer.

If lime stabilized soil is above the allowable tolerance, trim, remove, and dispose of the excess material. Do not leave loose material on the finished surface. If finish rolling cannot be completed within 2 hours of trimming, defer trimming.

If lime stabilized soil is below the allowable tolerance, you may use trimmed material to fill low areas only if final grading and final compaction occurs within 48 hours of beginning initial compaction. Before placing trimmed material, scarify the surface of the area to be filled at least 2 inches deep.

Finish rolling of trimmed surfaces must be performed with at least 1 complete coverage with steel drum or pneumatic-tired rollers.

### **24-1.03G Curing**

#### **General**

Choose the method of curing.

Apply the chosen cure method within 48 hours of completing the sheepsfoot or segmented wheel compaction. Apply the chosen cure method within the same day of any trimming and finish grading.

#### **Water Cure**

Water may be used to cure the finished surface before you place a moist material blanket, or apply curing seal. Keep the surface above the optimum moisture content of the lime stabilized soil. Use this method for no more than 3 days, after which you must place a curing seal or moist material blanket.

#### **Curing Seal**

Curing seal equipment must have a gage indicating the volume of curing seal in the storage tank.

If curing seal is used, apply it:

1. To the finished surface of lime stabilized soil under Section 94-1.06, "Applying," of the Standard Specifications
2. At a rate from 0.10 to 0.20 gallon per square yard. The Engineer determines the exact rate
3. When the lime stabilized soil is at optimum moisture
4. When the ambient temperature is above 40 °F and rising

Repair damaged curing seal the same day the damage occurs.

#### **Moist Material Blanket**

Moist material blanket consists of moist structural material. Moist material blanket may be a temporary or permanent layer of material of sufficient thickness to prevent drying of the lime stabilized soil. You may use moist material blanket if the lime stabilized soil can bear the weight of construction equipment. Maintain the moist material blanket above the optimum moisture content, as appropriate, until the next structural layer is placed.













## 39-1.02 MATERIALS

### 39-1.02A Geosynthetic Pavement Interlayer

Geosynthetic pavement interlayer must comply with the specifications for pavement fabric, paving mat, paving grid, paving geocomposite grid, or geocomposite strip membrane in Section 88-1.07, "Pavement Interlayer."

### 39-1.02B Tack Coat

Tack coat must comply with the specifications for asphaltic emulsion in Section 94, "Asphaltic Emulsion," or asphalt binder in Section 92, "Asphalts." Choose the type and grade.

Notify the Engineer if you dilute asphaltic emulsion with water. The weight ratio of added water to asphaltic emulsion must not exceed 1 to 1.

Measure added water either by weight or volume in compliance with the specifications for weighing, measuring, and metering devices under Section 9-1.01, "Measurement of Quantities," or you may use water meters from water districts, cities, or counties. If you measure water by volume, apply a conversion factor to determine the correct weight.

With each dilution, submit in writing:

1. The weight ratio of water to bituminous material in the original asphaltic emulsion
2. The weight of asphaltic emulsion before diluting
3. The weight of added water
4. The final dilution weight ratio of water to asphaltic emulsion

### 39-1.02C Asphalt Binder

Asphalt binder in HMA must comply with Section 92, "Asphalts," or Section 39-1.02D, "Asphalt Rubber Binder." The special provisions specify the grade.

Asphalt binder for geosynthetic pavement interlayer must comply with Section 92, "Asphalts." Choose from Grades PG 64-10, PG 64-16, or PG 70-10.

### 39-1.02D Asphalt Rubber Binder

#### General

Use asphalt rubber binder in RHMA-G, RHMA-O, and RHMA-O-HB. Asphalt rubber binder must be a combination of:

1. Asphalt binder
2. Asphalt modifier
3. Crumb rubber modifier (CRM)

The combined asphalt binder and asphalt modifier must be  $80.0 \pm 2.0$  percent by weight of the asphalt rubber binder.

#### Asphalt Modifier

Asphalt modifier must be a resinous, high flash point, and aromatic hydrocarbon, and comply with:

**Asphalt Modifier for Asphalt Rubber Binder**

Quality Characteristic	ASTM	Specification
Viscosity, $m^2/s$ ( $\times 10^{-6}$ ) at 100 °C	D 445	$X \pm 3^a$
Flash Point, CL.O.C., °C	D 92	207 minimum
Molecular Analysis		
Asphaltenes, percent by mass	D 2007	0.1 maximum
Aromatics, percent by mass	D 2007	55 minimum

Note:

<sup>a</sup> The symbol "X" is the proposed asphalt modifier viscosity. "X" must be between 19 and 36. A change in "X" requires a new asphalt rubber binder design.

Asphalt modifier must be from 2.0 percent to 6.0 percent by weight of the asphalt binder in the asphalt rubber binder.

#### Crumb Rubber Modifier

CRM consists of a ground or granulated combination of scrap tire CRM and high natural CRM. CRM must be  $75.0 \pm 2.0$  percent scrap tire CRM and  $25.0 \pm 2.0$  percent high natural CRM by total weight of CRM. Scrap tire CRM must be from any combination of automobile tires, truck tires, or tire buffings.

Sample and test scrap tire CRM and high natural CRM separately. CRM must comply with:

### Crumb Rubber Modifier for Asphalt Rubber Binder

Quality Characteristic	Test Method	Specification
Scrap tire CRM gradation (% passing No. 8 sieve)	LP-10	100
High natural CRM gradation (% passing No. 10 sieve)	LP-10	100
Wire in CRM (% max.)	LP-10	0.01
Fabric in CRM (% max.)	LP-10	0.05
CRM particle length (inch max.) <sup>a</sup>	--	3/16
CRM specific gravity <sup>a</sup>	CT 208	1.1 – 1.2
Natural rubber content in high natural CRM (%) <sup>a</sup>	ASTM D 297	40.0 – 48.0

Note:

<sup>a</sup> Test at mix design and for Certificate of Compliance.

Only use CRM ground and granulated at ambient temperature. If steel and fiber are cryogenically separated, it must occur before grinding and granulating. Only use cryogenically produced CRM particles that can be ground or granulated and not pass through the grinder or granulator.

CRM must be dry, free-flowing particles that do not stick together. CRM must not cause foaming when combined with the asphalt binder and asphalt modifier. You may add calcium carbonate or talc up to 3 percent by weight of CRM.

#### Asphalt Rubber Binder Design and Profile

Submit in writing an asphalt rubber binder design and profile that complies with the asphalt rubber binder specifications. In the design, designate the asphalt, asphalt modifier, and CRM and their proportions. The profile is not a performance specification and only serves to indicate expected trends in asphalt rubber binder properties during binder production. The profile must include the same component sources for the asphalt rubber binder used.

Design the asphalt rubber binder from testing you perform for each quality characteristic and for the reaction temperatures expected during production. The 24-hour (1,440-minute) interaction period determines the design profile. At a minimum, mix asphalt rubber binder components, take samples, and perform and record the following tests:

#### Asphalt Rubber Binder Reaction Design Profile

Test	Minutes of Reaction <sup>a</sup>							Limits
	45	60	90	120	240	360	1440	
Cone penetration @ 77 °F, 0.10-mm (ASTM D 217)	X <sup>b</sup>				X		X	25 - 70
Resilience @ 77 °F, percent rebound (ASTM D 5329)	X				X		X	18 min.
Field softening point, °F (ASTM D 36)	X				X		X	125 - 165
Viscosity, centipoises (LP-11)	X	X	X	X	X	X	X	1,500 - 4,000

Notes:

<sup>a</sup> Six hours (360 minutes) after CRM addition, reduce the oven temperature to 275 °F for a period of 16 hours. After the 16-hour (1320 minutes) cool-down after CRM addition, reheat the binder to the reaction temperature expected during production for sampling and testing at 24 hours (1440 minutes).

<sup>b</sup> "X" denotes required testing

#### Asphalt Rubber Binder

After interacting for a minimum of 45 minutes, asphalt rubber binder must comply with:

#### Asphalt Rubber Binder

Quality Characteristic	Test for Quality Control or Acceptance	Test Method	Specification	
			Minimum	Maximum
Cone penetration @ 77 °F, 0.10-mm	Acceptance	ASTM D 217	25	70
Resilience @ 77 °F, percent rebound	Acceptance	ASTM D 5329	18	--
Field softening point, °F	Acceptance	ASTM D 36	125	165
Viscosity @ 375 °F, centipoises	Quality Control	LP-11	1,500	4,000

#### 39-1.02E Aggregate

Aggregate must be clean and free from deleterious substances. Aggregate:

1. Retained on the No. 4 sieve is coarse
2. Passing the No. 4 sieve is fine
3. Added and passing the No. 30 sieve is supplemental fine, including:
  - 3.1. Hydrated lime
  - 3.2. Portland cement
  - 3.3. Fines from dust collectors

The special provisions specify the aggregate gradation for each HMA type.

The specified aggregate gradation is before the addition of asphalt binder and includes supplemental fines. The Engineer tests for aggregate grading under California Test 202, modified by California Test 105 if there is a difference in specific gravity of 0.2 or more between the coarse and fine parts of different aggregate blends.

Choose a sieve size target value (TV) within each target value limit presented in the aggregate gradation tables.

**Aggregate Gradation  
(Percentage Passing)  
HMA Types A and B**

3/4-inch HMA Types A and B

Sieve Sizes	Target Value Limits	Allowable Tolerance
1"	100	—
3/4"	90 - 100	TV ±5
1/2"	70 - 90	TV ±6
No. 4	45 - 55	TV ±7
No. 8	32 - 40	TV ±5
No. 30	12 - 21	TV ±4
No. 200	2 - 7	TV ±2

1/2-inch HMA Types A and B

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/4"	100	—
1/2"	95 - 99	TV ±6
3/8"	75 - 95	TV ±6
No. 4	55 - 66	TV ±7
No. 8	38 - 49	TV ±5
No. 30	15 - 27	TV ±4
No. 200	2 - 8	TV ±2

3/8-inch HMA Types A and B

Sieve Sizes	Target Value Limits	Allowable Tolerance
1/2"	100	—
3/8"	95 - 100	TV ±6
No. 4	58 - 72	TV ±7
No. 8	34 - 48	TV ±6
No. 30	18 - 32	TV ±5
No. 200	2 - 9	TV ±2

No. 4 HMA Types A and B

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/8"	100	—
No. 4	95 - 100	TV ±7
No. 8	72 - 77	TV ±7
No. 30	37 - 43	TV ±7
No. 200	2 - 12	TV ±4

**Rubberized Hot Mix Asphalt - Gap Graded (RHMA-G)**

3/4-inch RHMA-G

Sieve Sizes	Target Value Limits	Allowable Tolerance
1"	100	—
3/4"	95 - 100	TV ±5
1/2"	83 - 87	TV ±6
3/8"	65 - 70	TV ±6
No. 4	28 - 42	TV ±7
No. 8	14 - 22	TV ±5
No. 200	0 - 6	TV ±2

1/2-inch RHMA-G

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/4"	100	—
1/2"	90 - 100	TV ±6
3/8"	83 - 87	TV ±6
No. 4	28 - 42	TV ±7
No. 8	14 - 22	TV ±5
No. 200	0 - 6	TV ±2

**Open Graded Friction Course (OGFC)**

1-inch OGFC

Sieve Sizes	Target Value Limits	Allowable Tolerance
1 1/2"	100	—
1"	99 - 100	TV ±5
3/4"	85 - 96	TV ±5
1/2"	55 - 71	TV ±6
No. 4	10 - 25	TV ±7
No. 8	6 - 16	TV ±5
No. 200	1 - 6	TV ±2

1/2-inch OGFC

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/4"	100	—
1/2"	95 - 100	TV ±6
3/8"	78 - 89	TV ±6
No. 4	28 - 37	TV ±7
No. 8	7 - 18	TV ±5
No. 30	0 - 10	TV ±4
No. 200	0 - 3	TV ±2

3/8-inch OGFC

Sieve Sizes	Target Value Limits	Allowable Tolerance
1/2"	100	—
3/8"	90 - 100	TV ±6
No. 4	29 - 36	TV ±7
No. 8	7 - 18	TV ±6
No. 30	0 - 10	TV ±5
No. 200	0 - 3	TV ±2

Before the addition of asphalt binder and lime treatment, aggregate must comply with:

### Aggregate Quality

Quality Characteristic	Test Method	HMA Type			
		A	B	RHMA-G	OGFC
Percent of crushed particles	CT 205				
Coarse aggregate (% min.)					
One fractured face		90	25	--	90
Two fractured faces		75	--	90	75
Fine aggregate (% min.)	CT 205				
(Passing No. 4 sieve and retained on No. 8 sieve.)					
One fractured face		70	20	70	90
Los Angeles Rattler (% max.)	CT 211				
Loss at 100 Rev.		12	--	12	12
Loss at 500 Rev.		45	50	40	40
Sand equivalent (min.) <sup>a</sup>	CT 217	47	42	47	--
Fine aggregate angularity (% min.) <sup>b</sup>	CT 234	45	45	45	--
Flat and elongated particles (% max. by weight @ 5:1)	CT 235	10	10	10	10

Notes:

<sup>a</sup>Reported value must be the average of 3 tests from a single sample.

<sup>b</sup>The Engineer waives this specification if HMA contains less than 10 percent of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

#### 39-1.02F Reclaimed Asphalt Pavement

You may produce HMA using reclaimed asphalt pavement (RAP). HMA produced using RAP must comply with the specifications for HMA except aggregate quality specifications do not apply to RAP. You may substitute RAP aggregate for a part of the virgin aggregate in HMA in a quantity not exceeding 15.0 percent of the aggregate blend. Do not use RAP in OGFC and RHMA-G.

Assign the substitution rate of RAP aggregate for virgin aggregate with the job mix formula (JMF) submittal. The JMF must include the percent of RAP used. If you change your assigned RAP aggregate substitution rate by more than 5 percent (within the 15.0 percent limit), submit a new JMF.

Process RAP from asphalt concrete. You may process and stockpile RAP throughout the project's life. Prevent material contamination and segregation. Store RAP in stockpiles on smooth surfaces free of debris and organic material. Processed RAP stockpiles must consist only of homogeneous RAP.

#### 39-1.03 HOT MIX ASPHALT MIX DESIGN REQUIREMENTS

##### 39-1.03A General

A mix design consists of performing California Test 367 and laboratory procedures on combinations of aggregate gradations and asphalt binder contents to determine the optimum binder content (OBC) and HMA mixture qualities. If RAP is used, use Laboratory Procedure LP-9. The result of the mix design becomes the proposed JMF.

Use Form CEM-3512 to document aggregate quality and mix design data. Use Form CEM-3511 to present the JMF.

Laboratories testing aggregate qualities and preparing the mix design and JMF must be qualified under the Department's Independent Assurance Program. Take samples under California Test 125.

The Engineer reviews the aggregate qualities, mix design, and JMF and verifies and accepts the JMF.

You may change the JMF during production. Do not use the changed JMF until the Engineer accepts it. Except when adjusting the JMF in compliance with Section 39-1.03E, "Job Mix Formula Verification," perform a new mix design and submit in writing a new JMF submittal for changing any of the following:

1. Target asphalt binder percentage
2. Asphalt binder supplier
3. Asphalt rubber binder supplier
4. Component materials used in asphalt rubber binder or percentage of any component materials
5. Combined aggregate gradation
6. Aggregate sources
7. Substitution rate for RAP aggregate of more than 5 percent
8. Any material in the JMF

For OGFC, submit in writing a complete JMF submittal except asphalt binder content. The Engineer determines the asphalt binder content under California Test 368 within 20 days of your complete JMF submittal and provides you a Form CEM-3513.

**39-1.03B Hot Mix Asphalt Mix Design**

Perform a mix design that produces HMA in compliance with:

**Hot Mix Asphalt Mix Design Requirements**

Quality Characteristic	Test Method	HMA Type		
		A	B	RHMA-G
Air voids content (%)	CT 367 <sup>a</sup>	4.0	4.0	Special Provisions
Voids in mineral aggregate (% min.)	LP-2			
No. 4 grading		17.0	17.0	--
3/8" grading		15.0	15.0	--
1/2" grading		14.0	14.0	18.0 – 23.0 <sup>b</sup>
3/4" grading	13.0	13.0	18.0 – 23.0 <sup>b</sup>	
Voids filled with asphalt (%)	LP-3			
No. 4 grading		76.0 – 80.0	76.0 – 80.0	Note d
3/8" grading		73.0 – 76.0	73.0 – 76.0	
1/2" grading		65.0 – 75.0	65.0 – 75.0	
3/4" grading	65.0 – 75.0	65.0 – 75.0		
Dust proportion	LP-4			
No. 4 and 3/8" gradings		0.9 – 2.0	0.9 – 2.0	Note d
1/2" and 3/4" gradings	0.6 – 1.3	0.6 – 1.3		
Stabilometer value (min.) <sup>c</sup>	CT 366			
No. 4 and 3/8" gradings		30	30	--
1/2" and 3/4" gradings	37	35	23	

Notes:

<sup>a</sup> Calculate the air voids content of each specimen using California Test 309 and Lab Procedure LP-1. Modify California Test 367, Paragraph C5, to use the exact air voids content specified in the selection of OBC.

<sup>b</sup> Voids in mineral aggregate for RHMA-G must be within this range.

<sup>c</sup> Modify California Test 304, Part 2.B.2.c: "After compaction in the compactor, cool to 140 °± 5 °F by allowing the briquettes to cool at room temperature for 0.5-hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."

<sup>d</sup> Report this value in the JMF submittal.

For stability and air voids content, prepare 3 briquettes at the OBC and test for compliance. Report the average of 3 tests. Prepare new briquettes and test if the range of stability for the 3 briquettes is more than 8 points. The average air void content may vary from the specified air void content by ±0.5 percent.

You may use the briquettes used for stability testing to determine bulk specific gravity under CT 308. If you use the same briquettes and tests using bulk specific gravity fail, you may prepare 3 new briquettes and determine a new bulk specific gravity.

**39-1.03C Job Mix Formula Submittal**

Each JMF submittal must consist of:

1. Proposed JMF on Form CEM-3511
2. Mix design documentation on Form CEM-3512 dated within 12 months of submittal
3. JMF verification on Form CEM-3513, if applicable
4. JMF renewal on Form CEM-3514, if applicable
5. Materials Safety Data Sheets (MSDS) for:
  - 5.1. Asphalt binder
  - 5.2. Base asphalt binder used in asphalt rubber binder
  - 5.3. CRM and asphalt modifier used in asphalt rubber binder
  - 5.4. Blended asphalt rubber binder mixture
  - 5.5. Supplemental fine aggregate except fines from dust collectors

## 5.6. Antistrip additives

If the Engineer requests in writing, sample the following materials in the presence of the Engineer and place in labeled containers weighing no more than 50 pounds each:

1. Coarse, fine, and supplemental fine aggregate from stockpiles, cold feed belts, or hot bins. Samples must include at least 120 pounds for each coarse aggregate, 80 pounds for each fine aggregate, and 10 pounds for each type of supplemental fines. The Department combines these aggregate samples to comply with the JMF target values submitted on Form CEM-3511.
2. RAP from stockpiles or RAP system. Samples must be at least 60 pounds.
3. Asphalt binder from the binder supplier. Samples must be in two 1-quart cylindrical shaped cans with open top and friction lids.
4. Asphalt rubber binder with the components blended in the proportions to be used. Samples must be in four 1-quart cylindrical shaped cans with open top and friction lids.

Notify the Engineer in writing at least 2 business days before sampling materials. For aggregate and RAP, split the samples into at least 4 parts. Submit 3 parts to the Engineer and use 1 part for your testing.

### **39-1.03D Job Mix Formula Review**

The Engineer reviews each mix design and proposed JMF within 5 business days from the complete JMF submittal. The review consists of reviewing the mix design procedures and comparing the proposed JMF with the specifications.

The Engineer may verify aggregate qualities during this review period.

### **39-1.03E Job Mix Formula Verification**

If you cannot submit a Department-verified JMF on Form CEM-3513 dated within 12 months before HMA production, the Engineer verifies the JMF.

Based on your testing and production experience, you may submit on Form CEM-3511 an adjusted JMF before the Engineer's verification testing. JMF adjustments may include a change in the:

1. Asphalt binder content target value up to  $\pm 0.6$  percent from the optimum binder content value submitted on Form CEM-3512 except do not adjust the target value for asphalt rubber binder for RHMA-G below 7.0 percent
2. Aggregate gradation target values within the target value limits specified in the aggregate gradation tables

For HMA Type A, Type B, and RHMA-G, the Engineer verifies the JMF from samples taken from HMA produced by the plant to be used. Notify the Engineer in writing at least 2 business days before sampling materials.

In the Engineer's presence and from the same production run, take samples of:

1. Aggregate
2. Asphalt binder
3. RAP
4. HMA

Sample aggregate from cold feed belts or hot bins. Sample RAP from the RAP system. Sample HMA under California Test 125 except if you request in writing and the Engineer approves, you may sample from any of the following locations:

1. The plant
2. A truck
3. A windrow
4. The paver hopper
5. The mat behind the paver

You may sample from a different project including a non-Department project if you make arrangements for the Engineer to be present during sampling.

For aggregate, RAP, and HMA, split the samples into at least 4 parts and label their containers. Submit 3 split parts to the Engineer and use 1 part for your testing.

The Engineer verifies each proposed JMF within 20 days of receiving all verification samples and the JMF submittal has been accepted. If you request in writing, the Engineer verifies RHMA-G quality requirements within 3 business days of sampling. Verification is testing for compliance with the specifications for:

1. Aggregate quality
2. Aggregate gradation (JMF TV  $\pm$  tolerance)
3. Asphalt binder content (JMF TV  $\pm$  tolerance)
4. HMA quality specified in the table Hot Mix Asphalt Mix Design Requirements except:
  - 4.1. Air voids content (design value  $\pm$  2.0 percent)
  - 4.2. Voids filled with asphalt (report only if an adjustment for asphalt binder content target value is less than or equal to  $\pm$  0.3 percent from OBC)
  - 4.3. Dust proportion (report only if an adjustment for asphalt binder content target value is less than or equal to  $\pm$  0.3 percent from OBC)

The Engineer prepares 3 briquettes from a single split sample. To verify the JMF for stability and air voids content, the Engineer tests the 3 briquettes and reports the average of 3 tests. The Engineer prepares new briquettes if the range of stability for the 3 briquettes is more than 8 points.

The Engineer may use the briquettes used for stability testing to determine bulk specific gravity under CT 308. If the Engineer uses the same briquettes and the tests using bulk specific gravity fail, the Engineer prepares 3 new briquettes and determines a new bulk specific gravity.

If the Engineer verifies the JMF, the Engineer provides you a Form CEM-3513.

If the Engineer's tests on plant-produced samples do not verify the JMF, the Engineer notifies you in writing and you must submit a new JMF submittal or submit an adjusted JMF based on your testing. JMF adjustments may include a change in the:

1. Asphalt binder content target value up to  $\pm$ 0.6 percent from the optimum binder content value submitted on Form CEM-3512 except do not adjust the target value for asphalt rubber binder for RHMA-G below 7.0 percent
2. Aggregate gradation target values within the target value limits specified in the aggregate gradation tables

You may adjust the JMF only once due to a failed verification test. An adjusted JMF requires a new Form CEM-3511 and verification of a plant-produced sample.

The Engineer re-verifies the JMF if HMA production has stopped for longer than 30 days and the verified JMF is older than 12 months.

For each HMA type and aggregate size specified, the Engineer verifies at the State's expense up to 2 proposed JMF including a JMF adjusted after verification failure. The Engineer deducts \$3,000 from payments for each verification exceeding this limit. This deduction does not apply to verifications initiated by the Engineer or if a JMF expires while HMA production is stopped longer than 30 days.

### **39-1.03F Job Mix Formula Renewal**

You may request a JMF renewal by submitting the following:

1. Proposed JMF on Form CEM-3511
2. A previously verified JMF documented on Form CEM-3513 dated within 12 months
3. Mix design documentation on Form CEM-3512 used for the previously verified JMF

If the Engineer requests in writing, sample the following materials in the presence of the Engineer and place in labeled containers weighing no more than 50 pounds each:

1. Coarse, fine, and supplemental fine aggregate from stockpiles, cold feed belts, or hot bins. Samples must include at least 120 pounds for each coarse aggregate, 80 pounds for each fine aggregate, and 10 pounds for each type of supplemental fines. The Department combines these aggregate samples to comply with the JMF target values submitted on Form CEM-3511.
2. RAP from stockpiles or RAP system. Samples must be at least 60 pounds.
3. Asphalt binder from the binder supplier. Samples must be in two 1-quart cylindrical shaped cans with open top and friction lids.
4. Asphalt rubber binder with the components blended in the proportions to be used. Samples must be in four 1-quart cylindrical shaped cans with open top and friction lids.

Notify the Engineer in writing at least 2 business days before sampling materials. For aggregate and RAP, split samples into at least 4 parts. Submit 3 parts to the Engineer and use 1 part for your testing.

The Engineer reviews each complete JMF renewal submittal within 5 business days.

The Engineer may verify aggregate qualities during this review period.

Notify the Engineer in writing at least 2 business days before sampling materials. For aggregate, RAP, and HMA, split the samples into at least 4 parts. Submit 3 parts to the Engineer and use 1 part for your testing.

The Engineer verifies the JMF renewal submittal under Section 39-1.03E, "Job Mix Formula Verification," except:

1. The Engineer retains samples until you provide test results for your part on Form CEM-3514.
2. The Engineer tests samples of materials obtained from the HMA production unit after you submit test results that comply with the specifications for the quality characteristics under Section 39-1.03E, "Job Mix Formula Verification."
3. The Engineer verifies each proposed JMF within 30 days of receiving verification samples.
4. You may not adjust the JMF due to a failed verification.
5. For each HMA type and aggregate gradation specified, the Engineer verifies at the State's expense 1 proposed JMF.

If the Engineer verifies the JMF renewal, the Engineer provides you a Form CEM-3513.

### **39-1.03G Job Mix Formula Acceptance**

You may start HMA production if:

1. The Engineer's review of the JMF shows compliance with the specifications.
2. The Department has verified the JMF within 12 months before HMA production.
3. The Engineer accepts the verified JMF.

## **39-1.04 CONTRACTOR QUALITY CONTROL**

### **39-1.04A General**

Establish, maintain, and change a quality control system to ensure materials and work comply with the specifications. Submit quality control test results to the Engineer within 3 days of a request except when QC / QA is specified.

You must identify the HMA sampling location in your Quality Control Plan. During production, take samples under California Test 125 except if you request in writing and the Engineer approves, you may sample HMA from:

1. The plant
2. The truck
3. A windrow
4. The paver hopper
5. The mat behind the paver

### **39-1.04B Prepaving Conference**

Meet with the Engineer at a prepaving conference at a mutually agreed time and place. Discuss methods of performing the production and paving work.

### **39-1.04C Asphalt Rubber Binder**

Take asphalt rubber binder samples from the feed line connecting the asphalt rubber binder tank to the HMA plant. Sample and test asphalt rubber binder under Laboratory Procedure LP-11.

Test asphalt rubber binder for compliance with the viscosity specifications in Section 39-1.02, "Materials." During asphalt rubber binder production and HMA production using asphalt rubber binder, measure viscosity every hour with not less than 1 reading for each asphalt rubber binder batch. Log measurements with corresponding time and asphalt rubber binder temperature. Submit the log daily in writing.

Submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance." With the Certificate of Compliance, submit test results in writing for CRM and asphalt modifier with each truckload delivered to the HMA plant. A Certificate of Compliance for asphalt modifier must not represent more than 5,000 pounds. Use an AASHTO-certified laboratory for testing.

Sample and test gradation and wire and fabric content of CRM once per 10,000 pounds of scrap tire CRM and once per 3,400 pounds of high natural CRM. Sample and test scrap tire CRM and high natural CRM separately.

Submit certified weight slips in writing for the CRM and asphalt modifier furnished.

### **39-1.04D Aggregate**

Determine the aggregate moisture content and RAP moisture content in continuous mixing plants at least twice a day during production and adjust the plant controller. Determine the RAP moisture content in batch mixing plants at least twice a day during production and adjust the plant controller.

### **39-1.04E Reclaimed Asphalt Pavement**

Perform RAP quality control testing each day.

Sample RAP once daily and determine the RAP aggregate gradation under Laboratory Procedure LP-9 and submit the results to the Engineer in writing with the combined aggregate gradation.

### **39-1.04F Density Cores**

To determine density for Standard and QC / QA projects, take 4-inch or 6-inch diameter density cores at least once every 5 business days. Take 1 density core for every 250 tons of HMA from random locations the Engineer designates. Take density cores in the Engineer's presence and backfill and compact holes with material authorized by the Engineer. Before submitting a density core to the Engineer, mark it with the density core's location and place it in a protective container.

If a density core is damaged, replace it with a density core taken within 1 foot longitudinally from the original density core. Relocate any density core located within 1 foot of a rumble strip to 1 foot transversely away from the rumble strip.

### **39-1.04G Briquettes**

Prepare 3 briquettes for each stability and air voids content determination. Report the average of 3 tests. Prepare new briquettes and test if the range of stability for the 3 briquettes is more than 12 points.

You may use the briquettes used for stability testing to determine bulk specific gravity under CT 308. If you use these briquettes and tests using bulk specific gravity fail, you may prepare 3 new briquettes and determine a new bulk specific gravity.

### **39-1.05 ENGINEER'S ACCEPTANCE**

The Engineer's acceptance of HMA is specified in the sections for each HMA construction process.

The Engineer samples materials for testing under California Test 125 and the applicable test method except samples may be taken from:

1. The plant from:
  - 1.1. A truck
  - 1.2. An automatic sampling device
2. The mat behind the paver

Sampling must be independent of Contractor quality control, statistically-based, and random. If you request, the Engineer splits samples and provides you with a part.

The Engineer accepts HMA based on:

1. Accepted JMF
2. Accepted QCP for Standard and QC / QA
3. Compliance with the HMA Acceptance tables
4. Acceptance of a lot for QC / QA
5. Visual inspection

The Engineer prepares 3 briquettes for each stability and air voids content determination. The Engineer reports the average of 3 tests. The Engineer prepares new briquettes and test if the range of stability for the 3 briquettes is more than 8 points.

The Engineer may use the briquettes used for stability testing to determine bulk specific gravity under CT 308. If the Engineer uses the same briquettes and the tests using bulk specific gravity fail, the Engineer prepares 3 new briquettes and determines a new bulk specific gravity.

### **39-1.06 DISPUTE RESOLUTION**

You and the Engineer must work together to avoid potential conflicts and to resolve disputes regarding test result discrepancies. Notify the Engineer in writing within 5 days of receiving a test result if you dispute the test result.

If you or the Engineer dispute each other's test results, submit written quality control test results and copies of paperwork including worksheets used to determine the disputed test results to the Engineer. An Independent Third Party (ITP) performs referee testing. Before the ITP participates in a dispute resolution, the ITP must be accredited under the Department's Independent Assurance Program. The ITP must be independent of the project. By mutual agreement, the ITP is chosen from:

1. A Department laboratory
2. A Department laboratory in a district or region not in the district or region the project is located
3. The Transportation Laboratory
4. A laboratory not currently employed by you or your HMA producer

If split quality control or acceptance samples are not available, the ITP uses any available material representing the disputed HMA for evaluation.

### **39-1.07 PRODUCTION START-UP EVALUATION**

The Engineer evaluates HMA production and placement at production start-up.

Within the first 750 tons produced on the first day of HMA production, in the Engineer's presence and from the same production run, take samples of:

1. Aggregate
2. Asphalt binder
3. RAP
4. HMA

Sample aggregate from cold feed belts or hot bins. Take RAP samples from the RAP system. Sample HMA under California Test 125 except if you request in writing and the Engineer approves, you may sample HMA from:

1. The plant
2. The truck
3. A windrow
4. The paver hopper
5. The mat behind the paver

For aggregate, RAP, and HMA, split the samples into at least 4 parts and label their containers. Submit 3 split parts to the Engineer and keep 1 part.

For Standard and QC / QA projects, you and the Engineer must test the split samples and report test results in writing within 3 business days of sampling. If you proceed before receipt of the test results, the Engineer may consider the HMA placed to be represented by these test results.

For Standard and QC / QA projects, take 4-inch or 6-inch diameter density cores within the first 750 tons on the first day of HMA production. For each density core, the Engineer reports the bulk specific gravity determined under California Test 308, Method A in addition to the percent of maximum theoretical density. You may test for in-place density at the density core locations and include them in your production tests for percent of maximum theoretical density.

### **39-1.08 PRODUCTION**

#### **39-1.08A General**

Produce HMA in a batch mixing plant or a continuous mixing plant. Proportion aggregate by hot or cold feed control.

HMA plants must be Department-qualified. Before production, the HMA plant must have a current qualification under the Department's Materials Plant Quality Program.

During production, you may adjust:

1. Hot or cold feed proportion controls for virgin aggregate and RAP
2. The set point for asphalt binder content

#### **39-1.08B Mixing**

Mix HMA ingredients into a homogeneous mixture of coated aggregates.

Asphalt binder must be between 275 °F and 375 °F when mixed with aggregate.

Asphalt rubber binder must be between 375 °F and 425 °F when mixed with aggregate.

When mixed with asphalt binder, aggregate must not be more than 325 °F except aggregate for OGFC with unmodified asphalt binder must be not more than 275 °F. Aggregate temperature specifications do not apply when you use RAP.

HMA with or without RAP must not be more than 325 °F.

#### **39-1.08C Asphalt Rubber Binder**

Deliver scrap tire CRM and high natural CRM in separate bags.

Either proportion and mix asphalt binder, asphalt modifier, and CRM simultaneously or premix the asphalt binder and asphalt modifier before adding CRM. If you premix asphalt binder and asphalt modifier, asphalt binder must be from 375 to 425 degrees F when you add the asphalt modifier. Mix them for at least 20 minutes. When you add CRM, the asphalt binder and asphalt modifier must be between 375 °F and 425 °F.

Do not use asphalt rubber binder during the first 45 minutes of the reaction period. During this period, the asphalt rubber binder mixture must be between 375 °F and the lower of 425 °F or 25 °F below the asphalt binder's flash point indicated in the MSDS.

If any asphalt rubber binder is not used within 4 hours after the reaction period, discontinue heating. If the asphalt rubber binder drops below 375 °F, reheat before use. If you add more scrap tire CRM to the reheated asphalt rubber binder, the binder must undergo a 45-minute reaction period. The added scrap tire CRM must not exceed 10 percent of the total asphalt rubber binder weight. Reheated and reacted asphalt rubber binder must comply with the viscosity specifications for asphalt rubber binder in Section 39-1.02, "Materials." Do not reheat asphalt rubber binder more than twice.

**39-1.09 SUBGRADE, TACK COAT, AND GEOSYNTHETIC PAVEMENT INTERLAYER**

**39-1.09A General**

Prepare subgrade or apply tack coat to surfaces receiving HMA. If specified, place geosynthetic pavement interlayer over a coat of asphalt binder.

**39-1.09B Subgrade**

Subgrade to receive HMA must comply with the compaction and elevation tolerance specifications in the sections for the material involved. Subgrade must be free of loose and extraneous material. If HMA is paved on existing base or pavement, remove loose paving particles, dirt, and other extraneous material by any means including flushing and sweeping.

**39-1.09C Tack Coat**

Apply tack coat:

1. To existing pavement including planed surfaces
2. Between HMA layers
3. To vertical surfaces of:
  - 3.1. Curbs
  - 3.2. Gutters
  - 3.3. Construction joints

Before placing HMA, apply tack coat in 1 application at the minimum residual rate specified for the condition of the underlying surface:

**Tack Coat Application Rates for HMA Type A, Type B, and RHMA-G**

HMA over:	Minimum Residual Rates (gallons per square yard)		
	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h Asphaltic Emulsion	CRS1/CRS2, RS1/RS2 and QS1/CQS1 Asphaltic Emulsion	Asphalt Binder and PMRS2/PMCRS2 and PMRS2h/PMCRS2h Asphaltic Emulsion
New HMA (between layers)	0.02	0.03	0.02
PCC and existing HMA (AC) surfaces	0.03	0.04	0.03
Planed PCC and HMA (AC) surfaces	0.05	0.06	0.04

**Tack Coat Application Rates for OGFC**

OGFC over:	Minimum Residual Rates (gallons per square yard)		
	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h Asphaltic Emulsion	CRS1/CRS2, RS1/RS2 and QS1/CQS1 Asphaltic Emulsion	Asphalt Binder and PMRS2/PMCRS2 and PMRS2h/PMCRS2h Asphaltic Emulsion
New HMA	0.03	0.04	0.03
PCC and existing HMA (AC) surfaces	0.05	0.06	0.04
Planed PCC and HMA (AC) surfaces	0.06	0.07	0.05

If you dilute asphaltic emulsion, mix until homogeneous before application.  
 Apply to vertical surfaces with a residual tack coat rate that will thoroughly coat the vertical face without running off.  
 If you request in writing and the Engineer authorizes, you may:

1. Change tack coat rates
2. Omit tack coat between layers of new HMA during the same work shift if:
  - 2.1. No dust, dirt, or extraneous material is present
  - 2.2. The surface is at least 140 °F

Immediately in advance of placing HMA, apply additional tack coat to damaged areas or where loose or extraneous material is removed.

Close areas receiving tack coat to traffic. Do not track tack coat onto pavement surfaces beyond the job site.  
 Asphalt binder tack coat must be between 285 °F and 350 °F when applied.

**39-1.09D Geosynthetic Pavement Interlayer**

Place geosynthetic pavement interlayer in compliance with the manufacturer's recommendations.  
 Before placing the geosynthetic pavement interlayer and asphalt binder:

1. Repair cracks 1/4 inch and wider, spalls, and holes in the pavement. The State pays for this repair work under Section 4-1.03D, "Extra Work."
2. Clean the pavement of loose and extraneous material.

Immediately before placing the interlayer, apply 0.25 gallon ± 0.03 gallon of asphalt binder per square yard of interlayer or until the fabric is saturated. Apply asphalt binder the width of the geosynthetic pavement interlayer plus 3 inches on each side. At interlayer overlaps, apply asphalt binder on the lower interlayer the same overlap distance as the upper interlayer.

Asphalt binder must be from 285 °F to 350 °F and below the minimum melting point of the geosynthetic pavement interlayer when applied.

Align and place the interlayer with no overlapping wrinkles, except a wrinkle that overlaps may remain if it is less than 1/2 inch thick. If the overlapping wrinkle is more than 1/2 inch thick, cut the wrinkle out and overlap the interlayer no more than 2 inches.

The minimum HMA thickness over the interlayer must be 0.12 foot thick including conform tapers. Do not place the interlayer on a wet or frozen surface.

Overlap the interlayer borders between 2 inches and 4 inches. In the direction of paving, overlap the following roll with the preceding roll at any break.

You may use rolling equipment to correct distortions or wrinkles in the interlayer.

If asphalt binder tracked onto the interlayer or brought to the surface by construction equipment causes interlayer displacement, cover it with a small quantity of HMA.

Before placing HMA on the interlayer, do not expose the interlayer to:

1. Traffic except for crossings under traffic control and only after you place a small HMA quantity
2. Sharp turns from construction equipment
3. Damaging elements

Pave HMA on the interlayer during the same work shift.

### **39-1.10 SPREADING AND COMPACTING EQUIPMENT**

Paving equipment for spreading must be:

1. Self-propelled
2. Mechanical
3. Equipped with a screed or strike-off assembly that can distribute HMA the full width of a traffic lane
4. Equipped with a full-width compacting device
5. Equipped with automatic screed controls and sensing devices that control the thickness, longitudinal grade, and transverse screed slope

Install and maintain grade and slope references.

The screed must produce a uniform HMA surface texture without tearing, shoving, or gouging.

The paver must not leave marks such as ridges and indentations unless you can eliminate them by rolling.

Rollers must be equipped with a system that prevents HMA from sticking to the wheels. You may use a parting agent that does not damage the HMA or impede the bonding of layers.

In areas inaccessible to spreading and compacting equipment:

1. Spread the HMA by any means to obtain the specified lines, grades and cross sections.
2. Use a pneumatic tamper, plate compactor, or equivalent to achieve thorough compaction.

### **39-1.11 TRANSPORTING, SPREADING, AND COMPACTING**

Do not pave HMA on a wet pavement or frozen surface.

You may deposit HMA in a windrow and load it in the paver if:

1. Paver is equipped with a hopper that automatically feeds the screed
2. Loading equipment can pick up the windrowed material and deposit it in the paver hopper without damaging base material
3. Activities for deposit, pick-up, loading, and paving are continuous
4. HMA temperature in the windrow does not fall below 260 °F

You may pave HMA in 1 or more layers on areas less than 5 feet wide and outside the traveled way including shoulders. You may use mechanical equipment other than a paver for these areas. The equipment must produce a uniform smoothness and texture.

HMA handled, spread, or windrowed must not stain the finished surface of any improvement including pavement.

Do not use petroleum products such as kerosene or diesel fuel to release HMA from trucks, spreaders, or compactors.

HMA must be free of:

1. Segregation
2. Coarse or fine aggregate pockets
3. Hardened lumps

Longitudinal joints in the top layer must match specified lane edges. Alternate longitudinal joint offsets in lower layers at least 0.5 foot from each side of the specified lane edges. You may request in writing other longitudinal joint placement patterns.

Until the adjoining through lane's top layer has been paved, do not pave the top layer of:

1. Shoulders
2. Tapers
3. Transitions
4. Road connections
5. Driveways
6. Curve widenings
7. Chain control lanes
8. Turnouts
9. Turn pockets

If the number of lanes change, pave each through lane's top layer before paving a tapering lane's top layer. Simultaneous to paving a through lane's top layer, you may pave an adjoining area's top layer including shoulders. Do not operate spreading equipment on any area's top layer until completing final compaction.

If HMA (leveling) is specified, fill and level irregularities and ruts with HMA before spreading HMA over base, existing surfaces, or bridge decks. You may use mechanical equipment other than a paver for these areas. The equipment must produce a uniform smoothness and texture. HMA used to change an existing surface's cross slope or profile is not HMA (leveling).

If placing HMA against the edge of existing pavement, sawcut or grind the pavement straight and vertical along the joint and remove extraneous material without damaging the surface remaining in place. If placing HMA against the edge of a longitudinal or transverse construction joint and the joint is damaged or not placed to a neat line, sawcut or grind the pavement straight and vertical along the joint and remove extraneous material without damaging the surface remaining in place. Repair or remove and replace damaged pavement at your expense.

Rolling must leave the completed surface compacted and smooth without tearing, cracking, or shoving. Complete finish rolling activities before the pavement surface temperature is:

1. Below 150 °F for HMA with unmodified binder
2. Below 140 °F for HMA with modified binder
3. Below 200 °F for RHMA-G

If a vibratory roller is used as a finish roller, turn the vibrator off.

Do not use a pneumatic tired roller to compact RHMA-G.

For Standard and QC/QA, if a 3/4-inch aggregate grading is specified, you may use a 1/2-inch aggregate grading if the total layer thickness is from 0.125 foot to 0.20 foot thick.

Spread and compact HMA under Section 39-3.03, "Spreading and Compacting Equipment," and Section 39-3.04, "Transporting, Spreading, and Compacting," for any of the following:

1. Specified paved thickness is less than 0.15 foot.
2. Specified paved thickness is less than 0.20 foot and a 3/4-inch aggregate grading is specified and used.
3. You spread and compact at:
  - 3.1. Asphalt concrete surfacing replacement areas
  - 3.2. Leveling courses
  - 3.3. Areas the Engineer determines conventional compaction and compaction measurement methods are impeded

Do not allow traffic on new HMA pavement until its mid-depth temperature is below 160 °F.

If you request in writing and the Engineer authorizes, you may cool HMA Type A and Type B with water when rolling activities are complete. Apply water under Section 17, "Watering."

Spread sand at a rate between 1 pound and 2 pounds per square yard on new RHMA-G, RHMA-O, and RHMA-O-HB pavement when finish rolling is complete. Sand must be free of clay or organic matter. Sand must comply with Section 90-3.03, "Fine Aggregate Grading." Keep traffic off the pavement until spreading sand is complete.

### **39-1.12 SMOOTHNESS**

#### **39-1.12A General**

Determine HMA smoothness with a profilograph and a straightedge.

Smoothness specifications do not apply to OGFC placed on existing pavement not constructed under the same project.

If portland cement concrete is placed on HMA:

1. Cold plane the HMA finished surface to within specified tolerances if it is higher than the grade specified by the Engineer.
2. Remove and replace HMA if the finished surface is lower than 0.05 foot below the grade specified by the Engineer.

#### **39-1.12B Straightedge**

The HMA pavement top layer must not vary from the lower edge of a 12-foot long straightedge:

1. More than 0.01 foot when the straight edge is laid parallel with the centerline
2. More than 0.02 foot when the straightedge is laid perpendicular to the centerline and extends from edge to edge of a traffic lane
3. More than 0.02 foot when the straightedge is laid within 24 feet of a pavement conform

### 39-1.12C Profilograph

Under California Test 526, determine the zero (null) blanking band Profile Index ( $PI_0$ ) and must-grinds on the top layer of HMA Type A, Type B, and RHMA-G pavement. Take 2 profiles within each traffic lane, 3 feet from and parallel with the edge of each lane.

A must-grind is a deviation of 0.3 inch or more in a length of 25 feet. You must correct must-grinds.

For OGFC, only determine must-grinds when placed over HMA constructed under the same project. The top layer of the underlying HMA must comply with the smoothness specifications before placing OGFC.

Profile pavement in the Engineer's presence. Choose the time of profiling.

On tangents and horizontal curves with a centerline radius of curvature 2,000 feet or more, the  $PI_0$  must be at most 3 inches per 0.1-mile section.

On horizontal curves with a centerline radius of curvature between 1,000 feet and 2,000 feet including pavement within the superelevation transitions, the  $PI_0$  must be at most 6 inches per 0.1-mile section.

Before the Engineer accepts HMA pavement for smoothness, submit written final profilograms.

Submit 1 electronic copy of profile information in Microsoft Excel and 1 electronic copy of longitudinal pavement profiles in ".erd" format or other ProVAL compatible format to the Engineer and to:

Smoothness@dot.ca.gov

The following HMA pavement areas do not require a  $PI_0$ . You must measure these areas with a 12-foot straightedge and determine must-grinds with a profilograph:

1. New HMA with a total thickness less than or equal to 0.25 foot
2. HMA sections of city or county streets and roads, turn lanes and collector lanes that are less than 1,500 feet in length

The following HMA pavement areas do not require a  $PI_0$ . You must measure these areas with a 12-foot straightedge:

1. Horizontal curves with a centerline radius of curvature less than 1,000 feet including pavement within the superelevation transitions of those curves
2. Within 12 feet of a transverse joint separating the pavement from:
  - 2.1. Existing pavement not constructed under the same project
  - 2.2. A bridge deck or approach slab
3. Exit ramp termini, truck weigh stations, and weigh-in-motion areas
4. If steep grades and superelevation rates greater than 6 percent are present on:
  - 4.1. Ramps
  - 4.2. Connectors
5. Turn lanes
6. Areas within 15 feet of manholes or drainage transitions
7. Acceleration and deceleration lanes for at-grade intersections
8. Shoulders and miscellaneous areas
9. HMA pavement within 3 feet from and parallel to the construction joints formed between curbs, gutters, or existing pavement

### 39-1.12D Smoothness Correction

If the top layer of HMA Type A, Type B, or RHMA-G pavement does not comply with the smoothness specifications, grind the pavement to within tolerances, remove and replace it, or place a layer of HMA. The Engineer must authorize your choice of correction before the work begins.

Remove and replace the areas of OGFC not in compliance with the must-grind and straightedge specifications, except you may grind OGFC for correcting smoothness:

1. At a transverse joint separating the pavement from pavement not constructed under the same project
2. Within 12 feet of a transverse joint separating the pavement from a bridge deck or approach slab

Corrected HMA pavement areas must be uniform rectangles with edges:

1. Parallel to the nearest HMA pavement edge or lane line

2. Perpendicular to the pavement centerline

Measure the corrected HMA pavement surface with a profilograph and a 12-foot straightedge and correct the pavement to within specified tolerances. If a must-grind area or straightedged pavement cannot be corrected to within specified tolerances, remove and replace the pavement.

On ground areas not overlaid with OGFC, apply fog seal coat under Section 37-1, "Seal Coats."

### **39-1.13 MISCELLANEOUS AREAS AND DIKES**

Miscellaneous areas are outside the traveled way and include:

1. Median areas not including inside shoulders
2. Island areas
3. Sidewalks
4. Gutters
5. Gutter flares
6. Ditches
7. Overside drains
8. Aprons at the ends of drainage structures

Spread miscellaneous areas in 1 layer and compact to the specified lines and grades.

For miscellaneous areas and dikes:

1. Do not submit a JMF.
2. Choose the 3/8-inch or 1/2-inch HMA Type A and Type B aggregate gradations.
3. Minimum asphalt binder content must be 6.8 percent for 3/8-inch aggregate and 6.0 percent for 1/2-inch aggregate. If you request in writing and the Engineer authorizes, you may reduce the minimum asphalt binder content.
4. Choose asphalt binder Grade PG 70-10 or the same grade specified for HMA.

## **39-2 STANDARD**

### **39-2.01 DESCRIPTION**

If HMA is specified as Standard, construct it under Section 39-1, "General," this Section 39-2, "Standard," and Section 39-5, "Measurement and Payment."

### **39-2.02 CONTRACTOR QUALITY CONTROL**

#### **39-2.02A Quality Control Plan**

Establish, implement, and maintain a Quality Control Plan (QCP) for HMA. The QCP must describe the organization and procedures you will use to:

1. Control the quality characteristics
2. Determine when corrective actions are needed (action limits)
3. Implement corrective actions

When you submit the proposed JMF, submit the written QCP. You and the Engineer must discuss the QCP during the pre-paving conference.

The QCP must address the elements affecting HMA quality including:

1. Aggregate
2. Asphalt binder
3. Additives
4. Production
5. Paving

The Engineer reviews each QCP within 5 business days from the submittal. Hold HMA production until the Engineer accepts the QCP in writing. The Engineer's QCP acceptance does not mean your compliance with the QCP will result in acceptable HMA. Section 39-1.05, "Engineer's Acceptance," specifies HMA acceptance.

#### **39-2.02B Quality Control Testing**

Perform sampling and testing at the specified frequency for the following quality characteristics:



**Minimum Quality Control – Standard**

Quality Characteristic	Test Method	Minimum Sampling and Testing Frequency	HMA Type			
			A	B	RHMA-G	OGFC
Aggregate gradation <sup>a</sup>	CT 202	1 per 750 tons and any remaining part	JMF ± Tolerance <sup>b</sup>			
Sand equivalent (min.) <sup>c</sup>	CT 217		47	42	47	--
Asphalt binder content (%)	CT 379 or 382		JMF ± 0.45	JMF ± 0.45	JMF ± 0.50	JMF ± 0.50
HMA moisture content (% max.)	CT 226 or CT 370	1 per 2,500 tons but not less than 1 per paving day	1.0	1.0	1.0	1.0
Percent of maximum theoretical density (%) <sup>d,e</sup>	Quality control plan	2 per business day (min.)	91 - 97	91 - 97	91 - 97	--
Stabilometer value (min.) <sup>e,f</sup> No. 4 and 3/8" gradings 1/2" and 3/4" gradings	CT 366	One per 4,000 tons or 2 per 5 business days, whichever is more	30	30	--	--
			37	35	23	--
Air voids content (%) <sup>c,g</sup>	CT 367		4 ± 2	4 ± 2	Specification ± 2	--
Aggregate moisture content at continuous mixing plants and RAP moisture content at continuous mixing plants and batch mixing plants <sup>h</sup>	CT 226 or CT 370	2 per day during production	--	--	--	--
Percent of crushed particles coarse aggregate (% min.) One fractured face Two fractured faces Fine aggregate (% min) (Passing No. 4 sieve and retained on No. 8 sieve.) One fractured face	CT 205	As necessary and designated in the QCP. At least once per project	90	25	--	90
			75	--	90	75
			70	20	70	90
Los Angeles Rattler (% max.) Loss at 100 rev. Loss at 500 rev.	CT 211		12 45	-- 50	12 40	12 40

Flat and elongated particles (% max. by weight @ 5:1)	CT 235		Report only	Report only	Report only	Report only
Fine aggregate angularity (% min.)	CT 234		45	45	45	--
Voids filled with asphalt (%) <sup>i</sup> No. 4 grading 3/8" grading 1/2" grading 3/4" grading	LP-3		76.0 – 80.0 73.0 – 76.0 65.0 – 75.0 65.0 – 75.0	76.0 – 80.0 73.0 – 76.0 65.0 – 75.0 65.0 – 75.0	Report only	--
Voids in mineral aggregate (% min.) <sup>i</sup> No. 4 grading 3/8" grading 1/2" grading 3/4" grading	LP-2		17.0 15.0 14.0 13.0	17.0 15.0 14.0 13.0	-- -- 18.0 – 23.0 <sup>j</sup> 18.0 – 23.0 <sup>j</sup>	--
Dust proportion <sup>i</sup> No. 4 and 3/8" gradings 1/2" and 3/4" gradings	LP-4		0.9 – 2.0 0.6 – 1.3	0.9 – 2.0 0.6 – 1.3	Report only	--
Smoothness	Section 39-1.12	--	12-foot straightedge, must-grind, and PI <sub>0</sub>	12-foot straightedge, must-grind, and PI <sub>0</sub>	12-foot straightedge, must-grind, and PI <sub>0</sub>	12-foot straightedge and must-grind
Asphalt rubber binder viscosity @ 350 °F, centipoises	Section 39-1.02D	Section 39-1.04C	--	--	1,500 – 4,000	1,500 – 4,000
Asphalt modifier	Section 39-1.02D	Section 39-1.04C	--	--	Section 39-1.02D	Section 39-1.02D
Crumb rubber modifier	Section 39-1.02D	Section 39-1.04C	--	--	Section 39-1.02D	Section 39-1.02D

Notes:

<sup>a</sup> Determine combined aggregate gradation containing RAP under Laboratory Procedure LP-9.

<sup>b</sup> The tolerances must comply with the allowable tolerances in Section 39-1.02E, "Aggregate."

<sup>c</sup> Report the average of 3 tests from a single split sample.

<sup>d</sup> Required for HMA Type A, Type B, and RHMA-G if the specified paved thickness is at least 0.15 foot.

<sup>e</sup> Determine maximum theoretical density (California Test 309) at the frequency specified for Test Maximum Density under California Test 375, Part 5.D.

<sup>f</sup> Modify California Test 304, Part 2.B.2.c: "After compaction in the mechanical compactor, cool to 140 °F ± 5 °F by allowing the briquettes to cool at room temperature for 0.5 hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."

<sup>g</sup> Determine the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.

<sup>h</sup> For adjusting the plant controller at the HMA plant.

<sup>i</sup> Report only if the adjustment for asphalt binder content target value is less than or equal to ± 0.3 percent from OBC.

<sup>j</sup> Voids in mineral aggregate for RHMA-G must be within this range.

For any single quality characteristic except smoothness, if 2 consecutive quality control test results do not comply with the action limits or specifications:

1. Stop production.
2. Notify the Engineer in writing.
3. Take corrective action.
4. Demonstrate compliance with the specifications before resuming production and placement on the State highway.

**39-2.03 ENGINEER'S ACCEPTANCE**

**39-2.03A Testing**

The Engineer samples for acceptance testing and tests for:

**HMA Acceptance - Standard**

Quality Characteristic	Test Method	HMA Type			
		A	B	RHMA-G	OGFC
Aggregate gradation <sup>a</sup>	CT 202	JMF ± Tolerance <sup>c</sup>	JMF ± Tolerance <sup>c</sup>	JMF ± Tolerance <sup>c</sup>	JMF ± Tolerance <sup>c</sup>
Sieve 3/4" 1/2" 3/8"					
1/2" X <sup>b</sup>					
3/8" X					
No. 4 X					
No. 8 X X X					
No. 200 X X X					
Sand equivalent (min.) <sup>d</sup>	CT 217	47	42	47	--
Asphalt binder content (%)	CT 379 or 382	JMF ± 0.45	JMF ± 0.45	JMF ± 0.50	JMF ± 0.50
HMA moisture content (% max.)	CT 226 or CT 370	1.0	1.0	1.0	1.0
Percent of maximum theoretical density (%) <sup>e,f</sup>	CT 375	91 – 97	91 – 97	91 – 97	--
Stabilometer value (min.) <sup>d,g</sup>	CT 366	30	30	--	--
No. 4 and 3/8" gradings					
1/2" and 3/4" gradings		37	35	23	--
Air voids content (%) <sup>d,h</sup>	CT 367	4 ± 2	4 ± 2	Specification ± 2	--
Percent of crushed particles	CT 205				
Coarse aggregate (% min.)					
One fractured face					
Two fractured faces					
Fine aggregate (% min)		90	25	--	90
(Passing No. 4 sieve and retained on No. 8 sieve.)		75	--	90	75
One fractured face		70	20	70	90
Los Angeles Rattler (% max.)	CT 211	12	--	12	12
Loss at 100 rev.					
Loss at 500 rev.					
		45	50	40	40
Fine aggregate angularity (% min.)	CT 234	45	45	45	--
Flat and elongated particles (% max. by weight @ 5:1)	CT 235	Report only	Report only	Report only	Report only
Voids filled with asphalt (%) <sup>i</sup>	LP-3	76.0 – 80.0	76.0 – 80.0	Report only	--
No. 4 grading					
3/8" grading					
1/2" grading					
3/4" grading		65.0 – 75.0	65.0 – 75.0		
Voids in mineral aggregate (% min.) <sup>i</sup>	LP-2	17.0	17.0	--	--
No. 4 grading					
3/8" grading					
1/2" grading					
3/4" grading		15.0	15.0	--	--
		14.0	14.0	18.0 – 23.0 <sup>j</sup>	
		13.0	13.0	18.0 – 23.0 <sup>j</sup>	
Dust proportion <sup>i</sup>	LP-4	0.9 – 2.0	0.9 – 2.0	Report only	--
No. 4 and 3/8" gradings					
1/2" and 3/4" gradings		0.6 – 1.3	0.6 – 1.3		
Smoothness	Section 39-1.12	12-foot straightedge, must-grind, and PI <sub>0</sub>	12-foot straightedge, must-grind, and PI <sub>0</sub>	12-foot straightedge, must-grind, and PI <sub>0</sub>	12-foot straightedge and must-grind
Asphalt binder	Various	Section 92	Section 92	Section 92	Section 92
Asphalt rubber binder	Various	--	--	Section 92-	Section 92-

				1.02(C) and Section 39- 1.02D	1.02(C) and Section 39- 1.02D
Asphalt modifier	Various	--	--	Section 39- 1.02D	Section 39- 1.02D
Crumb rubber modifier	Various	--	--	Section 39- 1.02D	Section 39- 1.02D

<sup>a</sup> The Engineer determines combined aggregate gradations containing RAP under Laboratory Procedure LP-9.

<sup>b</sup> "X" denotes the sieves the Engineer considers for the specified aggregate gradation.

<sup>c</sup> The tolerances must comply with the allowable tolerances in Section 39-1.02E, "Aggregate."

<sup>d</sup> The Engineer reports the average of 3 tests from a single split sample.

<sup>e</sup> The Engineer determines percent of maximum theoretical density if the specified paved thickness is at least 0.15 foot under California Test 375 except the Engineer uses:

1. California Test 308, Method A, to determine in-place density of each density core instead of using the nuclear gauge in Part 4, "Determining In-Place Density By The Nuclear Density Device."
2. California Test 309 to determine maximum theoretical density instead of calculating test maximum density in Part 5, "Determining Test Maximum Density."

<sup>f</sup> The Engineer determines maximum theoretical density (California Test 309) at the frequency specified for Test Maximum Density under California Test 375, Part 5.D.

<sup>g</sup> Modify California Test 304, Part 2.B.2.c: "After compaction in the mechanical compactor, cool to 140 °F ± 5 °F by allowing the briquettes to cool at room temperature for 0.5 hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."

<sup>h</sup> The Engineer determines the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.

<sup>i</sup> Report only if the adjustment for asphalt binder content target value is less than or equal to ± 0.3 percent from OBC.

<sup>j</sup> Voids in mineral aggregate for RHMA-G must be within this range.

No single test result may represent more than the smaller of 750 tons or 1 day's production.

For any single quality characteristic except smoothness, if 2 consecutive acceptance test results do not comply with the specifications:

1. Stop production.
2. Take corrective action.
3. In the Engineer's presence, take samples and split each sample into 4 parts. Test 1 part for compliance with the specifications and submit 3 parts to the Engineer. The Engineer tests 1 part for compliance with the specifications and reserves and stores 2 parts.
4. Demonstrate compliance with the specifications before resuming production and placement on the State highway.

The Engineer tests the density core you take from each 250 tons of HMA production. The Engineer determines the percent of maximum theoretical density for each density core by determining the density core's density and dividing by the maximum theoretical density.

If the specified total paved thickness is at least 0.15 foot and any layer is less than 0.15 foot, the Engineer determines the percent of maximum theoretical density from density cores taken from the final layer measured the full depth of the total paved HMA thickness.

For percent of maximum theoretical density, the Engineer determines a deduction for each test result outside the specifications in compliance with:

**Reduced Payment Factors for Percent of Maximum Theoretical Density**

HMA Type A and B and RHMA-G Percent of Maximum Theoretical Density	Reduced Payment Factor	HMA Type A and B and RHMA-G Percent of Maximum Theoretical Density	Reduced Payment Factor
91.0	0.0000	97.0	0.0000
90.9	0.0125	97.1	0.0125
90.8	0.0250	97.2	0.0250
90.7	0.0375	97.3	0.0375
90.6	0.0500	97.4	0.0500
90.5	0.0625	97.5	0.0625
90.4	0.0750	97.6	0.0750
90.3	0.0875	97.7	0.0875
90.2	0.1000	97.8	0.1000
90.1	0.1125	97.9	0.1125
90.0	0.1250	98.0	0.1250
89.9	0.1375	98.1	0.1375
89.8	0.1500	98.2	0.1500
89.7	0.1625	98.3	0.1625
89.6	0.1750	98.4	0.1750
89.5	0.1875	98.5	0.1875
89.4	0.2000	98.6	0.2000
89.3	0.2125	98.7	0.2125
89.2	0.2250	98.8	0.2250
89.1	0.2375	98.9	0.2375
89.0	0.2500	99.0	0.2500
< 89.0	Remove and Replace	> 99.0	Remove and Replace

**39-2.04 TRANSPORTING, SPREADING, AND COMPACTING**

Determine the number of rollers needed to obtain the specified density and surface finish.

**39-3 METHOD**

**39-3.01 DESCRIPTION**

If HMA is specified as Method, construct it under Section 39-1, "General," this Section 39-3, "Method," and Section 39-5, "Measurement and Payment."

**39-3.02 ENGINEER'S ACCEPTANCE**

**39-3.02A Testing**

The Engineer samples for acceptance testing and tests for:

**HMA Acceptance - Method**

Quality Characteristic	Test Method	HMA Type			
		A	B	RHMA-G	OGFC
Aggregate gradation <sup>a</sup>	CT 202	JMF ± Tolerance <sup>b</sup>			
Sand equivalent (min.) <sup>c</sup>	CT 217	47	42	47	--
Asphalt binder content (%)	CT 379 or 382	JMF ± 0.45	JMF ± 0.45	JMF ± 0.50	JMF ± 0.50
HMA moisture content (% max.)	CT 226 or CT 370	1.0	1.0	1.0	1.0
Stabilometer value (min.) <sup>c, d</sup>	CT 366				
No. 4 and 3/8" gradings		30	30	--	--
1/2" and 3/4" gradings		37	35	23	--
Percent of crushed particles	CT 205				
Coarse aggregate (% min.)					
One fractured face		90	25	--	90
Two fractured faces		75	--	90	75
Fine aggregate (% min) (Passing No. 4 sieve and retained on No. 8 sieve.)					
One fractured face		70	20	70	90
Los Angeles Rattler (% max.)	CT 211				
Loss at 100 rev.		12	--	12	12
Loss at 500 rev.		45	50	40	40
Air voids content (%) <sup>c, e</sup>	CT 367	4 ± 2	4 ± 2	Specification ± 2	--
Fine aggregate angularity (% min.)	CT 234	45	45	45	--
Flat and elongated particles (% max. by weight @ 5:1)	CT 235	Report only	Report only	Report only	Report only
Voids filled with asphalt (%) <sup>f</sup>	LP-3			Report only	
No. 4 grading		76.0 – 80.0	76.0 – 80.0		--
3/8" grading		73.0 – 76.0	73.0 – 76.0		
1/2" grading		65.0 – 75.0	65.0 – 75.0		
3/4" grading		65.0 – 75.0	65.0 – 75.0		
Voids in mineral aggregate (% min.) <sup>f</sup>	LP-2				
No. 4 grading		17.0	17.0	--	--
3/8" grading		15.0	15.0	--	--
1/2" grading		14.0	14.0	18.0 – 23.0 <sup>g</sup>	
3/4" grading		13.0	13.0	18.0 – 23.0 <sup>g</sup>	
Dust proportion <sup>f</sup>	LP-4			Report only	
No. 4 and 3/8" gradings		0.9 – 2.0	0.9 – 2.0		--
1/2" and 3/4" gradings		0.6 – 1.3	0.6 – 1.3		
Smoothness	Section 39-1.12	12-foot straightedge and must-grind			
Asphalt binder	Various	Section 92	Section 92	Section 92	Section 92
Asphalt rubber binder	Various	--	--	Section 92-1.02(C) and Section 39-	Section 92-1.02(C) and Section 39-

				1.02D	1.02D
Asphalt modifier	Various	--	--	Section 39-1.02D	Section 39-1.02D
Crumb rubber modifier	Various	--	--	Section 39-1.02D	Section 39-1.02D

<sup>a</sup> The Engineer determines combined aggregate gradations containing RAP under Laboratory Procedure LP-9.

<sup>b</sup> The tolerances must comply with the allowable tolerances in Section 39-1.02E, "Aggregate."

<sup>c</sup> The Engineer reports the average of 3 tests from a single split sample.

<sup>d</sup> Modify California Test 304, Part 2.B.2.c: "After compaction in the mechanical compactor, cool to 140 °F ±5 °F by allowing the briquettes to cool at room temperature for 0.5 hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."

<sup>e</sup> The Engineer determines the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.

<sup>f</sup> Report only if the adjustment for asphalt binder content target value is less than or equal to ± 0.3 percent from OBC.

<sup>g</sup> Voids in mineral aggregate for RHMA-G must be within this range.

No single test result may represent more than the smaller of 750 tons or 1 day's production.

For any single quality characteristic except smoothness, if 2 consecutive acceptance test results do not comply with the specifications:

1. Stop production.
2. Take corrective action.
3. In the Engineer's presence, take samples and split each sample into 4 parts. Test 1 part for compliance with the specifications and submit 3 parts to the Engineer. The Engineer tests 1 part for compliance with the specifications and reserves and stores 2 parts.
4. Demonstrate compliance with the specifications before resuming production and placement on the State highway.

### 39-3.03 SPREADING AND COMPACTING EQUIPMENT

Each paver spreading HMA Type A and Type B must be followed by 3 rollers:

1. One vibratory roller specifically designed to compact HMA. The roller must be capable of at least 2,500 vibrations per minute and must be equipped with amplitude and frequency controls. The roller's gross static weight must be at least 7.5 tons.
2. One oscillating type pneumatic-tired roller at least 4 feet wide. Pneumatic tires must be of equal size, diameter, type, and ply. The tires must be inflated to 60 psi minimum and maintained so that the air pressure does not vary more than 5 psi.
3. One steel-tired, 2-axle tandem roller. The roller's gross static weight must be at least 7.5 tons.

Each roller must have a separate operator. Rollers must be self-propelled and reversible.

Compact RHMA-G under the specifications for compacting HMA Type A and Type B except do not use pneumatic-tired rollers.

Compact OGFC with steel-tired, 2-axle tandem rollers. If placing over 300 tons of OGFC per hour, use at least 3 rollers for each paver. If placing less than 300 tons of OGFC per hour, use at least 2 rollers for each paver. Each roller must weigh between 126 pounds to 172 pounds per linear inch of drum width. Turn the vibrator off.

### 39-3.04 TRANSPORTING, SPREADING, AND COMPACTING

Pave HMA in maximum 0.25-foot thick compacted layers.

If the surface to be paved is both in sunlight and shade, pavement surface temperatures are taken in the shade.

Spread HMA Type A and Type B only if atmospheric and surface temperatures are:

### Minimum Atmospheric and Surface Temperatures

Compacted Layer Thickness, feet	Minimum Atmospheric and Surface Temperatures			
	Atmospheric, ° F		Surface, ° F	
	Unmodified Asphalt Binder	Modified Asphalt Binder <sup>a</sup>	Unmodified Asphalt Binder	Modified Asphalt Binder <sup>a</sup>
< 0.15	55	50	60	55
0.15 – 0.25	45	45	50	50

Note:

<sup>a</sup> Except asphalt rubber binder.

If the asphalt binder for HMA Type A and Type B is:

1. Unmodified asphalt binder, complete:
  - 1.1. First coverage of breakdown compaction before the surface temperature drops below 250 °F
  - 1.2. Breakdown and intermediate compaction before the surface temperature drops below 200 °F
  - 1.3. Finish compaction before the surface temperature drops below 150 °F
2. Modified asphalt binder, complete:
  - 2.1. First coverage of breakdown compaction before the surface temperature drops below 240 °F
  - 2.2. Breakdown and intermediate compaction before the surface temperature drops below 180 °F
  - 2.3. Finish compaction before the surface temperature drops below 140 °F

For RHMA-G:

1. Only spread and compact if the atmospheric temperature is at least 55 °F and the surface temperature is at least 60 °F.
2. Complete the first coverage of breakdown compaction before the surface temperature drops below 280 °F.
3. Complete breakdown and intermediate compaction before the surface temperature drops below 250 °F.
4. Complete finish compaction before the surface temperature drops below 200 °F.
5. If the atmospheric temperature is below 70 °F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface.

For OGFC with unmodified asphalt binder:

1. Only spread and compact if the atmospheric temperature is at least 55 °F and the surface temperature is at least 60 °F.
2. Complete first coverage using 2 rollers before the surface temperature drops below 240 °F.
3. Complete all compaction before the surface temperature drops below 200 °F.
4. If the atmospheric temperature is below 70 °F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface.

For OGFC with modified asphalt binder except asphalt rubber binder:

1. Only spread and compact if the atmospheric temperature is at least 50 °F and the surface temperature is at least 50 °F.
2. Complete first coverage using 2 rollers before the surface temperature drops below 240 °F.
3. Complete all compaction before the surface temperature drops below 180 °F.
4. If the atmospheric temperature is below 70 °F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface.

For RHMA-O and RHMA-O-HB:

1. Only spread and compact if the atmospheric temperature is at least 55 °F and surface temperature is at least 60 °F.
2. Complete the 1st coverage using 2 rollers before the surface temperature drops below 280 °F.
3. Complete compaction before the surface temperature drops below 250 °F.
4. If the atmospheric temperature is below 70 °F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until the mixture is transferred to the paver's hopper or to the pavement surface.

For RHMA-G and OGFC, tarpaulins are not required if the time from discharge to truck until transfer to the paver's hopper or the pavement surface is less than 30 minutes.

HMA compaction coverage is the number of passes needed to cover the paving width. A pass is 1 roller's movement parallel to the paving in either direction. Overlapping passes are part of the coverage being made and are not a subsequent coverage. Do not start a coverage until completing the prior coverage.

Start rolling at the lower edge and progress toward the highest part.

Perform breakdown compaction of each layer of HMA Type A, Type B, and RHMA-G with 3 coverages using a vibratory roller. The speed of the vibratory roller in miles per hour must not exceed the vibrations per minute divided by 1,000. If the HMA layer thickness is less than 0.08 foot, turn the vibrator off. The Engineer may order fewer coverages if the HMA layer thickness is less than 0.15 foot.

Perform intermediate compaction of each layer of HMA Type A and Type B with 3 coverages using a pneumatic-tired roller at a speed not to exceed 5 mph.

Perform finish compaction of HMA Type A, Type B, and RHMA-G with 1 coverage using a steel-tired roller.

Compact OGFC with 2 coverages using steel-tired rollers.

### **39-4 QUALITY CONTROL / QUALITY ASSURANCE**

#### **39-4.01 DESCRIPTION**

If HMA is specified as Quality Control / Quality Assurance, construct it under Section 39-1, "General," this Section 39-4, "Quality Control / Quality Assurance," and Section 39-5, "Measurement and Payment."

#### **39-4.02 GENERAL**

The QC / QA construction process consists of:

1. Establishing, maintaining, and changing if needed a quality control system providing assurance the HMA complies with the specifications
2. Sampling and testing at specified intervals, or sublots, to demonstrate compliance and to control process
3. The Engineer sampling and testing at specified intervals to verify testing process and HMA quality
4. The Engineer using test results, statistical evaluation of verified quality control tests, and inspection to accept HMA for payment

A lot is a quantity of HMA. The Engineer designates a new lot when:

1. 20 sublots are complete
2. The JMF changes
3. Production stops for more than 30 days

Each lot consists of no more than 20 sublots. A subplot is 750 tons except HMA paved at day's end greater than 250 tons is a subplot. If HMA paved at day's end is less than 250 tons, you may either make this quantity a subplot or include it in the previous subplot's test results for statistical evaluation.

#### **39-4.03 CONTRACTOR QUALITY CONTROL**

##### **39-4.03A General**

Use a composite quality factor,  $QF_C$ , and individual quality factors,  $QF_{QC_i}$ , to control your process and evaluate your quality control program. For quality characteristics without quality factors, use your quality control plan's action limits to control process.

Control HMA quality including:

1. Materials
2. Proportioning
3. Spreading and compacting
4. Finished roadway surface

Develop, implement, and maintain a quality control program that includes:

1. Inspection
2. Sampling
3. Testing

### **39-4.03B Quality Control Plan**

With the JMF submittal, submit a written Quality Control Plan (QCP). The QCP must comply with the Department's Quality Control Manual for Hot Mix Asphalt Production and Placement. Discuss the QCP with the Engineer during the prepaving conference.

The Engineer reviews each QCP within 5 business days from the submittal. Hold HMA production until the Engineer accepts the QCP in writing. The Engineer's QCP acceptance does not mean your compliance with the QCP will result in acceptable HMA. Section 39-1.05, "Engineer's Acceptance," specifies HMA acceptance.

The QCP must include the name and qualifications of a Quality Control Manager. The Quality Control Manager administers the QCP and during paving must be at the job site within 3 hours of receiving notice. The Quality Control Manager must not be any of the following on the project:

1. Foreman
2. Production or paving crewmember
3. Inspector
4. Tester

The QCP must include action limits and details of corrective action you will take if a test result for any quality characteristic falls outside an action limit.

As work progresses, you must submit a written QCP supplement to change quality control procedures, personnel, tester qualification status, or laboratory accreditation status.

### **39-4.03C Quality Control Inspection, Sampling, And Testing**

Sample, test, inspect, and manage HMA quality control.

Provide a roadway inspector while HMA paving activities are in progress. Provide a plant inspector during HMA production.

Inspectors must comply with the Department's Quality Control Manual for Hot Mix Asphalt Production and Placement.

Provide a testing laboratory and personnel for quality control testing. Provide the Engineer unrestricted access to the quality control activities. Before providing services for the project, the Engineer reviews, accredits, and qualifies the testing laboratory and personnel under the Department's Independent Assurance Program.

The minimum random sampling and testing for quality control is:

**Minimum Quality Control – QC / QA**

Quality Characteristic	Test Method	Minimum Sampling and Testing Frequency	HMA Type			Location of Sampling	Max. Reporting Time Allowance
			A	B	RHMA-G		
Aggregate gradation <sup>a</sup>	CT 202	1 per 750 tons	JMF ± Tolerance <sup>b</sup>	JMF ± Tolerance <sup>b</sup>	JMF ± Tolerance <sup>b</sup>	CT 125	24 hours
Asphalt binder content (%)	CT 379 or 382		JMF ±0.45	JMF ±0.45	JMF ±0.5	Loose Mix Behind Paver See CT 125	
Percent of maximum theoretical density (%) <sup>c, d</sup>	QC Plan		92 - 96	92 - 96	91 - 96	QC Plan	
Aggregate moisture content at continuous mixing plants and RAP moisture content at continuous mixing plants and batch mixing plants <sup>e</sup>	CT 226 or CT 370	2 per day during production	--	--	--	Stock-piles or cold feed belts	--
Sand equivalent (min.) <sup>f</sup>	CT 217	1 per 750 tons	47	42	47	CT 125	24 hours
HMA moisture content (% max.)	CT 226 or CT 370	1 per 2,500 tons but not less than 1 per paving day	1.0	1.0	1.0	Loose Mix Behind Paver See CT 125	24 hours
Stabilometer Value (min.) <sup>f, g</sup> No. 4 and 3/8" gradings 1/2" and 3/4" gradings	CT 366	1 per 4,000 tons or 2 per 5 business days, whichever is more	30	30	--		48 hours
			37	35	23		
Air voids content (%) <sup>f, h</sup>	CT 367		4 ± 2	4 ± 2	Specification ± 2		

Percent of crushed particles coarse aggregate (% min.) One fractured face Two fractured faces	CT 205	As necessary and designated in QCP. At least once per project.	90	25	--	CT 125	48 hours
Fine aggregate (% min) (Passing No. 4 sieve and retained on No. 8 sieve.) One fractured face			75	--	90		
Los Angeles Rattler (% max.) Loss at 100 rev. Loss at 500 rev.	CT 211		12 45	-- 50	12 40	CT 125	
Fine aggregate angularity (% min.)	CT 234		45	45	45	CT 125	
Flat and elongated particle (% max. by weight @ 5:1)	CT 235		Report only	Report only	Report only	CT 125	
Voids filled with asphalt (%) <sup>i</sup> No. 4 grading 3/8" grading 1/2" grading 3/4" grading	LP-3		76.0 – 80.0 73.0 – 76.0 65.0 – 75.0 65.0 – 75.0	76.0 – 80.0 73.0 – 76.0 65.0 – 75.0 65.0 – 75.0	Report only	LP-3	
Voids in mineral aggregate (% min.) <sup>i</sup> No. 4 grading 3/8" grading 1/2" grading 3/4" grading	LP-2		17.0 15.0 14.0 13.0	17.0 15.0 14.0 13.0	-- -- 18.0 – 23.0 <sup>j</sup> 18.0 – 23.0 <sup>j</sup>	LP-2	
Dust proportion <sup>1</sup> No. 4 and 3/8" gradings 1/2" and 3/4" gradings	LP-4	0.9 – 2.0 0.6 – 1.3	0.9 – 2.0 0.6 – 1.3	Report only	LP-4		
Smoothness	Section 39-1.12	--	12-foot straight-edge, must-grind, and PI <sub>0</sub>	12-foot straight-edge, must-grind, and PI <sub>0</sub>	12-foot straight-edge, must-grind, and PI <sub>0</sub>	--	
Asphalt rubber binder viscosity @ 350 °F, centipoises	Section 39-1.02D	--	--	--	1,500 – 4,000	Section 39-1.02D	24 hours
Crumb rubber modifier	Section 39-1.02D	--	--	--	Section 39-1.02D	Section 39-1.02D	48 hours

Notes:

<sup>a</sup> Determine combined aggregate gradation containing RAP under Laboratory Procedure LP-9.

<sup>b</sup> The tolerances must comply with the allowable tolerances in Section 39-1.02E, "Aggregate."

<sup>c</sup> Required for HMA Type A, Type B, and RHMA-G if the specified paved thickness is at least 0.15 foot.

<sup>d</sup> Determine maximum theoretical density (California Test 309) at the frequency specified for test maximum density under California Test 375, Part 5 D.

<sup>e</sup> For adjusting the plant controller at the HMA plant.

<sup>f</sup> Report the average of 3 tests from a single split sample.

<sup>g</sup> Modify California Test 304, Part 2.B.2.c: "After compaction in the mechanical compactor, cool to 140 °F ± 5 °F by allowing the briquettes to cool at room temperature for 0.5 hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."

<sup>h</sup> Determine the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.

<sup>i</sup> Report only if the adjustment for asphalt binder content target value is less than or equal to ± 0.3 percent from OBC.

<sup>j</sup> Voids in mineral aggregate for RHMA-G must be within this range.

Within the specified reporting time, submit written test results including:

1. Sampling location, quantity, and time
2. Testing results
3. Supporting data and calculations

If test results for any quality characteristic are beyond the action limits in the QCP, take corrective actions. Document the corrective actions taken in the inspection records under Section 39-4.03E, "Records of Inspection and Testing."

Stop production, notify the Engineer in writing, take corrective action, and demonstrate compliance with the specifications before resuming production and placement on the State highway if:

1. A lot's composite quality factor,  $QF_C$ , or an individual quality factor,  $QF_{QCi}$  for  $i = 3, 4, \text{ or } 5$ , is below 0.90 determined under Section 39-4.03F, "Statistical Evaluation," using quality control data
2. An individual quality factor,  $QF_{QCi}$  for  $i = 1 \text{ or } 2$ , is below 0.75 using quality control data
3. Quality characteristics for which a quality factor,  $QF_{QCi}$ , is not determined has 2 consecutive quality control tests not in compliance with the specifications

#### **39-4.03D Charts And Records**

Record sampling and testing results for quality control on forms provided in the "Quality Control Manual for Hot Mix Asphalt," or on forms you submit with the QCP. The QCP must also include form posting locations and submittal times.

Submit quality control test results using the Department's statistical evaluation program, HMAPay, available at

[www.dot.ca.gov/hq/construc/hma/index.htm](http://www.dot.ca.gov/hq/construc/hma/index.htm)

#### **39-4.03E Records Of Inspection And Testing**

During HMA production, submit in writing a daily:

1. HMA Construction Daily Record of Inspection. Also make this record available at the HMA plant and job site each day.
2. HMA Inspection and Testing Summary. Include in the summary:
  - 2.1. QC worksheet with updated test results from the HMAPay program
  - 2.2. Test forms with the testers' signatures and Quality Control Manager's initials.
  - 2.3. Inspection forms with the inspectors' signatures and Quality Control Manager's initials.
  - 2.4. A list and explanation of deviations from the specifications or regular practices.
  - 2.5. A signed statement by the Quality Control Manager that says:

"It is hereby certified that the information contained in this record is accurate, and that information, tests, or calculations documented herein comply with the specifications of the contract and the standards set forth in the testing procedures. Exceptions to this certification are documented as part of this record."

Retain for inspection the records generated as part of quality control including inspection, sampling, and testing for at least 3 years after final acceptance.

#### **39-4.03F Statistical Evaluation**

##### **General**

Determine a lot's composite quality factor,  $QF_C$ , and the individual quality factors,  $QF_{QCi}$ . Perform statistical evaluation calculations to determine these quality factors based on quality control test results for:

1. Aggregate gradation
2. Asphalt binder content
3. Percent of maximum theoretical density

The Engineer grants a waiver and you must use 1.0 as the individual quality factor for percent of maximum theoretical density,  $QF_{QC5}$ , for HMA paved in:

1. Areas where the total paved thickness is less than 0.15 foot
2. Areas where the total paved thickness is less than 0.20 foot and a 3/4-inch grading is specified and used
3. Dig outs
4. Leveling courses
5. Areas where, in the opinion of the Engineer, compaction or compaction measurement by conventional methods is impeded

### Statistical Evaluation Calculations

Use the Variability-Unknown / Standard Deviation Method to determine the percentage of a lot not in compliance with the specifications.

Determine the percentage of work not in compliance with the specification limits for each quality characteristic as follows:

1. Calculate the arithmetic mean ( $\bar{X}$ ) of the test values

$$\bar{X} = \frac{\sum X}{n}$$

where:

x = individual test values  
n = number of test values

2. Calculate the standard deviation

$$s = \sqrt{\frac{n(\sum x^2) - (\sum x)^2}{n(n-1)}}$$

where:

$\sum(x^2)$  = sum of the squares of individual test values  
 $(\sum x)^2$  = sum of the individual test values squared  
n = number of test values

3. Calculate the upper quality index ( $Q_u$ )

$$Q_u = \frac{USL - \bar{X}}{s}$$

where:

USL = target value plus the production tolerance or upper specification limit  
s = standard deviation  
 $\bar{X}$  = arithmetic mean

4. Calculate the lower quality index ( $Q_L$ );

$$Q_L = \frac{\bar{X} - LSL}{s}$$

where:

LSL = target value minus production tolerance or lower specification limit  
s = standard deviation

$\bar{X}$  = arithmetic mean

5. From the table, Upper Quality Index  $Q_U$  or Lower Quality Index  $Q_L$ , of this Section 39-4.03F, "Statistical Evaluation", determine  $P_U$ ;

where:

$P_U$  = the estimated percentage of work outside the USL.  
 $P_U = 0$ , when USL is not specified.

6. From the table, Upper Quality Index  $Q_U$  or Lower Quality Index  $Q_L$ , of this Section 39-4.03F, "Statistical Evaluation," determine  $P_L$ ;

where:

$P_L$  = the estimated percentage of work outside the LSL.  
 $P_L = 0$ , when LSL is not specified.

7. Calculate the total estimated percentage of work outside the USL and LSL, percent defective

$$\text{Percent defective} = P_U + P_L$$

$P_U$  and  $P_L$  are determined from:

P <sub>U</sub> or P <sub>L</sub>	Upper Quality Index Q <sub>U</sub> or Lower Quality Index Q <sub>L</sub>												
	Sample Size (n)												
	5	6	7	8	9	10-11	12-14	15-17	18-22	23-29	30-42	43-66	>66
0	1.72	1.88	1.99	2.07	2.13	2.20	2.28	2.34	2.39	2.44	2.48	2.51	2.56
1	1.64	1.75	1.82	1.88	1.91	1.96	2.01	2.04	2.07	2.09	2.12	2.14	2.16
2	1.58	1.66	1.72	1.75	1.78	1.81	1.84	1.87	1.89	1.91	1.93	1.94	1.95
3	1.52	1.59	1.63	1.66	1.68	1.71	1.73	1.75	1.76	1.78	1.79	1.80	1.81
4	1.47	1.52	1.56	1.58	1.60	1.62	1.64	1.65	1.66	1.67	1.68	1.69	1.70
5	1.42	1.47	1.49	1.51	1.52	1.54	1.55	1.56	1.57	1.58	1.59	1.59	1.60
6	1.38	1.41	1.43	1.45	1.46	1.47	1.48	1.49	1.50	1.50	1.51	1.51	1.52
7	1.33	1.36	1.38	1.39	1.40	1.41	1.41	1.42	1.43	1.43	1.44	1.44	1.44
8	1.29	1.31	1.33	1.33	1.34	1.35	1.35	1.36	1.36	1.37	1.37	1.37	1.38
9	1.25	1.27	1.28	1.28	1.29	1.29	1.30	1.30	1.30	1.31	1.31	1.31	1.31
10	1.21	1.23	1.23	1.24	1.24	1.24	1.25	1.25	1.25	1.25	1.25	1.26	1.26
11	1.18	1.18	1.19	1.19	1.19	1.19	1.20	1.20	1.20	1.20	1.20	1.20	1.20
12	1.14	1.14	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
13	1.10	1.10	1.10	1.10	1.10	1.10	1.11	1.11	1.11	1.11	1.11	1.11	1.11
14	1.07	1.07	1.07	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
15	1.03	1.03	1.03	1.03	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
16	1.00	0.99	0.99	0.99	0.99	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
17	0.97	0.96	0.95	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.94	0.94	0.94
18	0.93	0.92	0.92	0.92	0.91	0.91	0.91	0.91	0.90	0.90	0.90	0.90	0.90
19	0.90	0.89	0.88	0.88	0.88	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
20	0.87	0.86	0.85	0.85	0.84	0.84	0.84	0.83	0.83	0.83	0.83	0.83	0.83
21	0.84	0.82	0.82	0.81	0.81	0.81	0.80	0.80	0.80	0.80	0.80	0.80	0.79
22	0.81	0.79	0.79	0.78	0.78	0.77	0.77	0.77	0.76	0.76	0.76	0.76	0.76
23	0.77	0.76	0.75	0.75	0.74	0.74	0.74	0.73	0.73	0.73	0.73	0.73	0.73
24	0.74	0.73	0.72	0.72	0.71	0.71	0.70	0.70	0.70	0.70	0.70	0.70	0.70
25	0.71	0.70	0.69	0.69	0.68	0.68	0.67	0.67	0.67	0.67	0.67	0.67	0.66
26	0.68	0.67	0.67	0.65	0.65	0.65	0.64	0.64	0.64	0.64	0.64	0.64	0.63
27	0.65	0.64	0.63	0.62	0.62	0.62	0.61	0.61	0.61	0.61	0.61	0.61	0.60
28	0.62	0.61	0.60	0.59	0.59	0.59	0.58	0.58	0.58	0.58	0.58	0.58	0.57
29	0.59	0.58	0.57	0.57	0.56	0.56	0.55	0.55	0.55	0.55	0.55	0.55	0.54
30	0.56	0.55	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.52	0.52	0.52	0.52
31	0.53	0.52	0.51	0.51	0.50	0.50	0.50	0.49	0.49	0.49	0.49	0.49	0.49
32	0.50	0.49	0.48	0.48	0.48	0.47	0.47	0.47	0.46	0.46	0.46	0.46	0.46
33	0.47	0.48	0.45	0.45	0.45	0.44	0.44	0.44	0.44	0.43	0.43	0.43	0.43
34	0.45	0.43	0.43	0.42	0.42	0.42	0.41	0.41	0.41	0.41	0.41	0.41	0.40
35	0.42	0.40	0.40	0.39	0.39	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38
36	0.39	0.38	0.37	0.37	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
37	0.36	0.35	0.34	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.32
38	0.33	0.32	0.32	0.31	0.31	0.31	0.30	0.30	0.30	0.30	0.30	0.30	0.30
39	0.30	0.30	0.29	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
40	0.28	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
41	0.25	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
42	0.23	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
43	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
44	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
45	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
46	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
47	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
48	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
49	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1. If the value of Q<sub>U</sub> or Q<sub>L</sub> does not correspond to a value in the table, use the next lower value.
2. If Q<sub>U</sub> or Q<sub>L</sub> are negative values, P<sub>U</sub> or P<sub>L</sub> is equal to 100 minus the table value for P<sub>U</sub> or P<sub>L</sub>.

### Quality Factor Determination

Determine individual quality factors,  $QF_{QC_i}$ , using percent defective =  $P_U + P_L$  and:

Quality Factor	Quality Factors												
	Maximum Allowable Percent Defective ( $P_U + P_L$ )												
	Sample Size (n)												
	5	6	7	8	9	10-11	12-14	15-17	18-22	23-29	30-42	43-66	>66
1.05				0	0	0	0	0	0	0	0	0	0
1.04			0	1	3	5	4	4	4	3	3	3	3
1.03		0	2	4	6	8	7	7	6	5	5	4	4
1.02		1	3	6	9	11	10	9	8	7	7	6	6
1.01	0	2	5	8	11	13	12	11	10	9	8	8	7
1.00	22	20	18	17	16	15	14	13	12	11	10	9	8
0.99	24	22	20	19	18	17	16	15	14	13	11	10	9
0.98	26	24	22	21	20	19	18	16	15	14	13	12	10
0.97	28	26	24	23	22	21	19	18	17	16	14	13	12
0.96	30	28	26	25	24	22	21	19	18	17	16	14	13
0.95	32	29	28	26	25	24	22	21	20	18	17	16	14
0.94	33	31	29	28	27	25	24	22	21	20	18	17	15
0.93	35	33	31	29	28	27	25	24	22	21	20	18	16
0.92	37	34	32	31	30	28	27	25	24	22	21	19	18
0.91	38	36	34	32	31	30	28	26	25	24	22	21	19
0.90	39	37	35	34	33	31	29	28	26	25	23	22	20
0.89	41	38	37	35	34	32	31	29	28	26	25	23	21
0.88	42	40	38	36	35	34	32	30	29	27	26	24	22
0.87	43	41	39	38	37	35	33	32	30	29	27	25	23
0.86	45	42	41	39	38	36	34	33	31	30	28	26	24
0.85	46	44	42	40	39	38	36	34	33	31	29	28	25
0.84	47	45	43	42	40	39	37	35	34	32	30	29	27
0.83	49	46	44	43	42	40	38	36	35	33	31	30	28
0.82	50	47	46	44	43	41	39	38	36	34	33	31	29
0.81	51	49	47	45	44	42	41	39	37	36	34	32	30
0.80	52	50	48	46	45	44	42	40	38	37	35	33	31
0.79	54	51	49	48	46	45	43	41	39	38	36	34	32
0.78	55	52	50	49	48	46	44	42	41	39	37	35	33
0.77	56	54	52	50	49	47	45	43	42	40	38	36	34
0.76	57	55	53	51	50	48	46	44	43	41	39	37	35
0.75	58	56	54	52	51	49	47	46	44	42	40	38	36
Reject	60	57	55	53	52	51	48	47	45	43	41	40	37
	61	58	56	55	53	52	50	48	46	44	43	41	38
	62	59	57	56	54	53	51	49	47	45	44	42	39
	63	61	58	57	55	54	52	50	48	47	45	43	40
	64	62	60	58	57	55	53	51	49	48	46	44	41

Reject Values Greater Than Those Shown Above

Notes:

- To obtain a quality factor when the estimated percent outside specification limits from table, "Upper Quality Index  $Q_U$  or Lower Quality Index  $Q_L$ ," does not correspond to a value in the table, use the next larger value.

Compute the composite of single quality factors,  $QF_C$ , for a lot using:

$$QF_C = \sum_{i=1}^5 w_i QF_{QC_i}$$

where:

- $QF_C$  = the composite quality factor for the lot rounded to 2 decimal places.
- $QF_{QC_i}$  = the quality factor for the individual quality characteristic.
- $w$  = the weighting factor listed in the table HMA Acceptance – QC / QA.

$i =$  the quality characteristic index number in the table HMA Acceptance – QC / QA.

### 39-4.04 ENGINEER'S QUALITY ASSURANCE

#### 39-4.04A General

The Engineer assures quality by:

1. Reviewing mix designs and proposed JMF
2. Inspecting procedures
3. Conducting oversight of quality control inspection and records
4. Verification sampling and testing during production and paving

#### 39-4.04B Verification Sampling And Testing

##### General

The Engineer samples:

1. Aggregate to verify gradation
2. HMA to verify asphalt binder content

##### Verification

For aggregate gradation and asphalt binder content, the ratio of verification testing frequency to the minimum quality control testing frequency is 1:5. The Engineer performs at least 3 verification tests per lot.

Using the t-test, the Engineer compares quality control tests results for aggregate gradation and asphalt binder content with corresponding verification test results. The Engineer uses the average and standard deviation of up to 20 sequential sublots for the comparison. The Engineer uses production start-up evaluation tests to represent the first subplot. When there are less than 20 sequential sublots, the Engineer uses the maximum number of sequential sublots available. The 21st subplot becomes the 1st subplot ( $n = 1$ ) in the next lot.

The t-value for a group of test data is computed as follows:

$$t = \frac{|\bar{X}_c - \bar{X}_v|}{S_p \sqrt{\frac{1}{n_c} + \frac{1}{n_v}}} \quad \text{and} \quad S_p^2 = \frac{S_c^2(n_c - 1) + S_v^2(n_v - 1)}{n_c + n_v - 2}$$

where:

$n_c =$  Number of quality control tests (2 minimum, 20 maximum).

$n_v =$  Number of verification tests (minimum of 1 required).

$\bar{X}_c =$  Mean of quality control tests.

$\bar{X}_v =$  Mean of verification tests.

$S_p =$  Pooled standard deviation (When  $n_v = 1$ ,  $S_p = S_c$ ).

$S_c =$  Standard deviation of quality control tests.

$S_v =$  Standard deviation of verification tests (when  $n_v > 1$ ).

The comparison of quality control test results and the verification test results is at a level of significance of  $\alpha = 0.025$ . The Engineer computes t and compares it to the critical t-value,  $t_{crit}$ , from:

**Critical T-Value**

Degrees of freedom ( $n_c+n_v-2$ )	$t_{crit}$ (for $\alpha = 0.025$ )	Degrees of freedom ( $n_c+n_v-2$ )	$t_{crit}$ (for $\alpha = 0.025$ )
1	24.452	18	2.445
2	6.205	19	2.433
3	4.177	20	2.423
4	3.495	21	2.414
5	3.163	22	2.405
6	2.969	23	2.398
7	2.841	24	2.391
8	2.752	25	2.385
9	2.685	26	2.379
10	2.634	27	2.373
11	2.593	28	2.368
12	2.560	29	2.364
13	2.533	30	2.360
14	2.510	40	2.329
15	2.490	60	2.299
16	2.473	120	2.270
17	2.458	$\infty$	2.241

If the t-value computed is less than or equal to  $t_{crit}$ , quality control test results are verified.

If the t-value computed is greater than  $t_{crit}$  and both  $\bar{X}_v$  and  $\bar{X}_c$  comply with acceptance specifications, the quality control tests are verified. You may continue to produce and place HMA with the following allowable differences:

1.  $\left| \bar{X}_v - \bar{X}_c \right| \leq 1.0$  percent for any grading
2.  $\left| \bar{X}_v - \bar{X}_c \right| \leq 0.1$  percent for asphalt binder content

If the t-value computed is greater than  $t_{crit}$  and the  $\left| \bar{X}_v - \bar{X}_c \right|$  for grading and asphalt binder content are greater than the allowable differences, quality control test results are not verified and:

1. The Engineer notifies you in writing.
2. You and the Engineer must investigate why the difference exist.
3. If the reason for the difference cannot be found and corrected, the Engineer's test results are used for acceptance and pay.

**39-4.05 ENGINEER'S ACCEPTANCE**

**39-4.05A Testing**

The Engineer samples for acceptance testing and tests for:

**HMA Acceptance – QC / QA**

Index (i)	Quality Characteristic				Weight -ing Factor (w)	Test Method	HMA Type		
							A	B	RHMA-G
	Aggregate gradation <sup>a</sup>					CT 202	JMF ± Tolerance <sup>c</sup>		
	Sieve	3/4"	1/2"	3/8"					
1	1/2"	X <sup>b</sup>	--	--	0.05				
1	3/8"	--	X	--	0.05				
1	No. 4	--	--	X	0.05				
2	No. 8	X	X	X	0.10				
3	No. 200	X	X	X	0.15				
4	Asphalt binder content (%)				0.30	CT 379 or 382	JMF ± 0.45	JMF ± 0.45	JMF ± 0.5
5	Percent of maximum theoretical density (%) <sup>d, e</sup>				0.40	CT 375	92 – 96	92 – 96	91 – 96
	Sand equivalent (min.) <sup>f</sup>					CT 217	47	42	47
	Stabilometer value (min.) <sup>f, g</sup>					CT 366			
	No. 4 and 3/8" gradings						30	30	--
	1/2" and 3/4" gradings						37	35	23
	Air voids content (%) <sup>f, h</sup>					CT 367	4 ± 2	4 ± 2	Specification ± 2
	Percent of crushed particles coarse aggregate (% min.)					CT 205			
	One fractured face						90	25	--
	Two fractured faces						75	--	90
	Fine aggregate (% min.) (Passing No. 4 sieve and retained on No. 8 sieve.)								
	One fractured face						70	20	70
	HMA moisture content (% max.)					CT 226 or CT 370	1.0	1.0	1.0
	Los Angeles Rattler (% max.)					CT 211			
	Loss at 100 rev.						12	--	12
	Loss at 500 rev.						45	50	40
	Fine aggregate angularity (% min.)					CT 234	45	45	45
	Flat and elongated particle (% max. by weight @ 5:1)					CT 235	Report only	Report only	Report only
	Voids in mineral aggregate (% min.) <sup>1</sup>								(Note j)
	No. 4 grading					LP-2	17.0	17.0	--
	3/8" grading						15.0	15.0	--
	1/2" grading						14.0	14.0	18.0 - 23.0
	3/4" grading						13.0	13.0	18.0 - 23.0
	Voids filled with asphalt (%) <sup>1</sup>								
	No. 4 grading					LP-3	76.0 - 80.0	76.0 - 80.0	Report only
	3/8" grading						73.0 - 76.0	73.0 - 76.0	
	1/2" grading						65.0 - 75.0	65.0 - 75.0	
	3/4" grading						65.0 - 75.0	65.0 - 75.0	
	Dust proportion <sup>1</sup>					LP-4			
	No. 4 and 3/8" gradings						0.9 - 2.0	0.9 – 2.0	Report only
	1/2" and 3/4" gradings						0.6 - 1.3	0.6 – 1.3	

	Smoothness		Section 39-1.12	12-foot straight-edge, must-grind, and PI <sub>0</sub>	12-foot straight-edge, must-grind, and PI <sub>0</sub>	12-foot straight-edge, must-grind, and PI <sub>0</sub>
	Asphalt binder		Various	Section 92	Section 92	Section 92
	Asphalt rubber binder		Various	--	--	Section 92-1.02(C) and Section 39-1.02D
	Asphalt modifier		Various	--	--	Section 39-1.02D
	Crumb rubber modifier		Various	--	--	Section 39-1.02D

Notes:

<sup>a</sup> The Engineer determines combined aggregate gradations containing RAP under Laboratory Procedure LP-9.

<sup>b</sup> "X" denotes the sieves the Engineer considers for the specified aggregate gradation.

<sup>c</sup> The tolerances must comply with the allowable tolerances in Section 39-1.02E, "Aggregate."

<sup>d</sup> The Engineer determines percent of maximum theoretical density if the specified paved thickness is at least 0.15 foot under California Test 375 except the Engineer uses:

1. California Test 308, Method A, to determine in-place density of each density core instead of using the nuclear gauge in Part 4, "Determining In-Place Density By The Nuclear Density Device."
2. California Test 309 to determine maximum theoretical density instead of calculating test maximum density in Part 5, "Determining Test Maximum Density."

<sup>e</sup> The Engineer determines maximum theoretical density (California Test 309) at the frequency specified for Test Maximum Density under California Test 375, Part 5.D.

<sup>f</sup> The Engineer reports the average of 3 tests from a single split sample.

<sup>g</sup> Modify California Test 304, Part 2.B.2.c: "After compaction in the mechanical compactor, cool to 140 °F ± 5 °F by allowing the briquettes to cool at room temperature for 0.5 hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."

<sup>h</sup> The Engineer determines the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.

<sup>i</sup> Report only if the adjustment for asphalt binder content target value is less than or equal to ± 0.3 percent from OBC.

<sup>j</sup> Voids in mineral aggregate for RHMA-G must be within this range.

The Engineer determines the percent of maximum theoretical density from the average density of 3 density cores you take from every 750 tons of production or part thereof divided by the maximum theoretical density.

If the specified total paved thickness is at least 0.15 foot and any layer is less than 0.15 foot, the Engineer determines the percent of maximum theoretical density from density cores taken from the final layer measured the full depth of the total paved HMA thickness.

The Engineer calculates  $QF_{QC_i}$  for  $i = 1, 2, 3,$  and  $4$  using quality control data and  $QF_{QC_i}$  for  $i = 5$  using quality assurance data.

The Engineer stops production and terminates a lot if:

1. The lot's composite quality factor,  $QF_C$ , or an individual quality factor,  $QF_{QC_i}$  for  $i = 3, 4,$  or  $5$ , is below 0.90 determined under Section 39-4.03F, "Statistical Evaluation"
2. An individual quality factor,  $QF_{QC_i}$  for  $i = 1$  or  $2$ , is below 0.75
3. Quality characteristics for which a quality factor,  $QF_{QC_i}$ , is not determined has 2 consecutive acceptance or quality control tests not in compliance with the specifications

For any single quality characteristic for which a quality factor,  $QF_{QC_i}$ , is not determined, except smoothness, if 2 consecutive acceptance test results do not comply with specifications:

1. Stop production.

2. Take corrective action.
3. In the Engineer's presence, take samples and split each sample into 4 parts. Test 1 part for compliance with the specifications and submit 3 parts to the Engineer. The Engineer tests 1 part for compliance with the specifications and reserves and stores 2 parts.
4. Demonstrate compliance with the specifications before resuming production and placement on the State highway.

### 39-4.05B Statistical Evaluation, Determination Of Quality Factors And Acceptance

#### Statistical Evaluation and Determination of Quality Factors

To determine the individual quality factor,  $QF_{QC_i}$ , for any quality factor  $i = 1$  through 5 or a lot's composite quality factor,  $QF_C$ , for acceptance and payment adjustment, the Engineer uses the evaluation specifications under Section 39-4.03F, "Statistical Evaluation," and:

1. Verified quality control test results for aggregate gradation
2. Verified quality control test results for asphalt binder content
3. The Engineer's test results for percent of maximum theoretical density

#### Lot Acceptance Based on Quality Factors

The Engineer accepts a lot based on the quality factors determined for aggregate gradation and asphalt binder content,  $QF_{QC_i}$  for  $i = 1$  through 4, using the total number of verified quality control test result values and the total percent defective ( $P_U + P_L$ ).

The Engineer accepts a lot based on the quality factor determined for maximum theoretical density,  $QF_{QC_5}$ , using the total number of test result values from density cores and the total percent defective ( $P_U + P_L$ ).

The Engineer calculates the quality factor for the lot,  $QF_C$ , which is a composite of weighted individual quality factors,  $QF_{QC_i}$ , determined for each quality characteristic in the HMA Acceptance – QC / QA table in Section 39-4.05A, "Testing."

The Engineer accepts a lot based on quality factors if:

1. The current composite quality factor,  $QF_C$ , is 0.90 or greater
2. Each individual quality factor,  $QF_{QC_i}$  for  $i = 3, 4,$  and  $5$ , is 0.90 or greater
3. Each individual quality factor,  $QF_{QC_i}$  for  $i = 1$  and  $2$ , is 0.75 or greater

No single quality characteristic test may represent more than the smaller of 750 tons or 1 day's production.

#### Payment Adjustment

If a lot is accepted, the Engineer adjusts payment with the following formula:

$$PA = \sum_{i=1}^n HMA CP * w_i * [QF_{QC_i} * (HMATT - WHMATT) + WHMATT] - (HMA CP * HMATT)$$

where:

$PA =$	Payment adjustment rounded to 2 decimal places.
$HMA CP =$	HMA contract price.
$HMATT =$	HMA total tons represented in the lot.
$WHMATT_i =$	Total tons of waived quality characteristic HMA.
$QF_{QC_i} =$	Running quality factor for the individual quality characteristic. $QF_{QC_i}$ for $i = 1$ through 4 must be from verified Contractor's QC results. $QF_{QC_5}$ must be determined from the Engineer's results on density cores taken for percent of maximum theoretical density determination.
$w =$	Weighting factor listed in the HMA acceptance table.
$i =$	Quality characteristic index number in the HMA acceptance table.

If the payment adjustment is a negative value, the Engineer deducts this amount from payment. If the payment adjustment is a positive value, the Engineer adds this amount to payment.

The 21st subplot becomes the 1st subplot ( $n = 1$ ) in the next lot. When the 21st sequential subplot becomes the 1st subplot, the previous 20 sequential sublots become a lot for which the Engineer determines a quality factor. The Engineer uses this quality factor to pay for the HMA in the lot. If the next lot consists of less than 8 sublots, these sublots must be added to the previous lot for quality factor determination using 21 to 27 sublots.

### **39-4.05C Dispute Resolution**

For a lot, if you or the Engineer dispute any quality factor,  $QF_{QCi}$ , or verification test result, every subplot in that lot must be retested.

Referee tests must be performed under the specifications for acceptance testing.

Any quality factor,  $QF_{QCi}$ , must be determined using the referee tests.

For any quality factor,  $QF_{QCi}$ , for  $i = 1$  through 5, dispute resolution:

1. If the difference between the quality factors for  $QF_{QCi}$  using the referee test result and the disputed test result is less than or equal to 0.01, the original test result is correct.
2. If the difference between the quality factor for  $QF_{QCi}$  using the referee test result and the disputed test result is more than 0.01, the quality factor determined from the referee tests supersedes the previously determined quality factor.

## **39-5 MEASUREMENT AND PAYMENT**

### **39-5.01 MEASUREMENT**

The contract item for HMA is measured by weight. The weight of each HMA mixture designated in the Engineer's Estimate must be the combined mixture weight.

If tack coat, asphalt binder, and asphaltic emulsion are paid with separate contract items, their contract items are measured under Section 92, "Asphalts," or Section 94, "Asphaltic Emulsions," as the case may be.

If recorded batch weights are printed automatically, the contract item for HMA is measured by using the printed batch weights, provided:

1. Total aggregate and supplemental fine aggregate weight per batch is printed. If supplemental fine aggregate is weighed cumulatively with the aggregate, the total aggregate batch weight must include the supplemental fine aggregate weight.
2. Total asphalt binder weight per batch is printed.
3. Each truckload's zero tolerance weight is printed before weighing the first batch and after weighing the last batch.
4. Time, date, mix number, load number and truck identification is correlated with a load slip.
5. A copy of the recorded batch weights is certified by a licensed weighmaster and submitted to the Engineer.

The contract item for placing HMA dike is measured by the linear foot along the completed length. The contract item for placing HMA in miscellaneous areas is measured as the in-place compacted area in square yards. In addition to the quantities measured on a linear foot or square yard basis, the HMA for dike and miscellaneous areas are measured by weight.

The contract item for geosynthetic pavement interlayer is measured by the square yard for the actual pavement area covered.

### **39-5.02 PAYMENT**

The contract prices paid per ton for hot mix asphalt as designated in the Engineer's Estimate include full compensation for furnishing all labor, materials, tools, equipment, and incidentals for doing all the work involved in constructing hot mix asphalt, complete in place, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

If HMA is specified to comply with Section 39-4, "Quality Control / Quality Assurance," the Engineer adjusts payment under that section.

Full compensation for the Quality Control Plan and prepaving conference is included in the contract prices paid per ton for hot mix asphalt as designated in the Engineer's Estimate and no additional compensation will be allowed therefor.

Full compensation for performing and submitting mix designs and for Contractor sampling, testing, inspection, testing facilities, and preparation and submittal of results is included in the contract prices paid per ton for HMA as designated in the Engineer's Estimate and no additional compensation will be allowed therefor.

Full compensation for reclaimed asphalt pavement is included in the contract prices paid per ton for HMA as designated in the Engineer's Estimate and no additional compensation will be allowed therefor.

The contract price paid per ton for hot mix asphalt (leveling) includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals for doing all the work involved in hot mix asphalt (leveling), complete in place, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

The State pays for HMA dike at the contract price per linear foot for place HMA dike and by the ton for HMA. The contract prices paid per linear foot for place hot mix asphalt dike as designated in the Engineer's Estimate include full compensation for furnishing all labor, tools, equipment, and incidentals, and for doing all the work involved in placing HMA dike, complete in place, including excavation, backfill, and preparation of the area to receive the dike, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.



## 40-1 GENERAL

### 40-1.01 SUMMARY

Section 40 includes specifications for constructing concrete pavement on a prepared subgrade.

### 40-1.02 SUBMITTALS

#### 40-1.02A Certificates of Compliance

Submit Certificates of Compliance under Section 6-1.07, "Certificates of Compliance." Include a test result report for any specified test with certification that test was performed within 12 months before the tested material's use.

Submit Certificates of Compliance for:

1. Tie bars
2. Threaded tie bar splice couplers
3. Dowel bars
4. Tie bar baskets
5. Dowel bar baskets
6. Chemical adhesive (drill and bond)
7. Silicone joint sealant
8. Asphalt rubber joint sealant
9. Preformed compression seal
10. Backer rods. Include the manufacturer's statement of compatibility with the sealant to be used.
11. Joint filler material
12. Curing compound. For each delivery to the job site, submit a copy of the Certificate of Compliance to the Engineer and the Transportation Laboratory. Each Certificate of Compliance must not represent more than 10,000 gallons and must include a test result report for:
  - 12.1. Moisture loss at 24 hours under California Test 534
  - 12.2. Reflectance under ASTM E 1347
  - 12.3. Viscosity under ASTM D 2196
  - 12.4. Nonvolatile content under ASTM D 2369
  - 12.5. Pigment content under ASTM D 3723

13. Epoxy powder coating

#### 40-1.02B Curing Compound Samples

Submit split curing compound samples to the Transportation Laboratory.

#### 40-1.02C Drilled Corings

Submit each core taken for Engineer's acceptance in a plastic bag. Mark each core with a location description.

#### 40-1.02D Independent Third Party Air Content Testing Laboratory

Before testing, submit for the Engineer's approval the name of a laboratory that will test drilled core specimens for air content in cases of dispute.

#### 40-1.02E Dowel Bars

Before placing dowel bars, submit a procedure for identifying transverse contraction joint locations relative to the dowel bars' longitudinal center and a procedure for consolidating concrete around the dowel bars.

#### 40-1.02F Concrete Field Qualification

Submit field qualification data and test reports including:

1. Mixing date
2. Mixing equipment and procedures used
3. Batch volume in cubic yards
4. Type and source of ingredients used
5. Penetration of the concrete
6. Air content of the plastic concrete
7. Age and strength at time of concrete beam testing

Field qualification test reports must be certified with a signature by an official in responsible charge of the laboratory performing the tests.

#### **40-1.02G Frequency Measuring Device (Tachometer)**

Submit calibration documentation and operational guidelines for frequency measuring devices for concrete consolidation vibrators.

#### **40-1.02H Manufacturer's Recommendations and Instructions**

If used and at least 15 days before delivery to the job site, submit manufacturer's recommendations and instructions for storage and installation of:

1. Threaded tie bar splice couplers
2. Chemical adhesive (drill and bond)
3. Silicone liquid sealant
4. Asphalt rubber liquid sealant
5. Preformed compression seals
6. Joint filler material

#### **40-1.02I Mix Proportions**

At least 15 days before starting testing for mix proportions under California Test 559, submit a copy of the AASHTO accreditation for your laboratory determining the mix proportions. At least 30 days before starting field qualification, submit under California Test 559 the proposed concrete mix proportions, the corresponding mix identifications, and laboratory test reports including the modulus of rupture for each trial mixture at 10, 21, 28, and 42 days.

#### **40-1.02J Preformed Compression Seal**

Submit the manufacturer's data sheet used to develop the recommended preformed compression seal based on the joint dimensions.

#### **40-1.02K Concrete Pavement Early Age Crack Mitigation System**

At least 24 hours before each paving shift, submit:

1. Early age stress and strength predictions
2. Scheduled sawing and curing activities
3. Contingency plan if volunteer cracking occurs

At least 24 hours before paving, meet with the Engineer to review the submittals for the early age crack mitigation system.

During paving, update the system with current weather data obtained from a portable weather station. Before paving concrete pavement with these updates, submit new stress and strength predictions and curing and sawing activity schedules.

#### **40-1.02L Profilograms**

Submit profilograms within 5 business days of initial profiling and within 2 business days of profiling corrected sections. Submit 1 electronic copy of profile information in ".erd" format or other ProVAL compatible format to the Engineer and to:

Smoothness@dot.ca.gov

Submit the original of final profilograms before the Engineer accepts the contract. Submitted profilograms become the Department's property.

#### **40-1.02M Protecting Concrete Pavement During Cold Weather**

Submit a plan for protecting concrete pavement when the average ambient daily temperature is below 40 °F and daytime ambient temperature is less than 50 °F during the initial 72 hours after paving.

#### **40-1.02N Quality Control Charts**

Submit updated quality control charts each paving day.

#### **40-1.02O Quality Control Plan**

At least 30 days before the start of field qualification, submit a concrete pavement quality control plan (QCP).

#### **40-1.03 QUALITY CONTROL AND ASSURANCE**

##### **40-1.03A Contractor Quality Control Plan**

Establish, implement, and maintain a QCP for concrete pavement. The QCP must describe the organization and procedures you use to:

1. Control the production process
2. Determine if changes to the production process are needed
3. Implement changes

The QCP must address the elements affecting concrete pavement quality including:

1. Mix proportions
2. Aggregate gradation
3. Materials quality
4. Stockpile management
5. Line and grade control
6. Proportioning
7. Mixing and transportation
8. Placing and consolidation
9. Contraction and construction joints
10. Dowel bar placement, alignment, and anchorage
11. Tie bar placement
12. Modulus of rupture
13. Finishing and curing
14. Surface smoothness
15. Joint sealant and compression seal installation

The QCP must include details of corrective action to be taken if any process is out of control. As a minimum, a process is out of control if any of the following occurs:

1. For fine and coarse aggregate gradation, 2 consecutive running averages of 4 tests are outside the specification limits
2. For fine and coarse aggregates, the moisture content of either aggregate changes by more than 0.5 percentage point from any reading
3. For individual penetration or air content measurements:
  - 3.1. One point falls outside the suspension limit line
  - 3.2. Two points in a row fall outside the action limit line

Stop production and take corrective action for out of control processes except fine and coarse aggregate moisture content or the Engineer rejects subsequent material.

##### **40-1.03B Quality Control Testing**

Select random locations and perform sampling and testing in compliance with:

**Quality Control Testing**

Test	Frequency	Test Method
Cleanness value	2 per day	CT 227
Sand equivalent	2 per day	CT 217
Aggregate gradation	2 per day	CT 202
Air content (freeze thaw) <sup>a</sup>	1 per hour	CT 504
Air content (non-freeze thaw)	1 per 4 hours	CT 504
Density	1 per 4 hours	CT 518
Penetration	1 per 4 hours	CT 533
Calibration of moisture meter <sup>b, c</sup>	1 per day	CT 223 or CT 226

Notes:

<sup>a</sup> If air entrainment is specified, make at least 1 air content measurement per hour. If air entrainment is not specified, make at least 1 air content measurement per 4 hours.

<sup>b</sup> Make at least 1 measurement of moisture content per week to check the calibration of an electronically actuated moisture meter.

<sup>c</sup> Random location sampling and testing is not applicable.

If air entrainment is specified, the testing laboratory and tester must be qualified under the Department's Independent Assurance Manual. The manual is available from the Transportation Laboratory.

**40-1.03C Control Charts**

Maintain control charts to identify potential problems and assignable causes. Post a copy of each control chart at a location determined by the Engineer.

Individual measurement control charts must use the target values in the mix proportions as indicators of central tendency.

Develop linear control charts for:

1. Cleanness value
2. Sand equivalent
3. Fine and coarse aggregate gradation
4. Air content
5. Penetration

Control charts must include:

1. Contract number
2. Mix proportions
3. Test number
4. Each test parameter
5. Action and suspension limits
6. Specification limits
7. Quality control test results

For fine and coarse aggregate gradation control charts, record the running average of the previous 4 consecutive gradation tests for each sieve and superimpose the specification limits.

For penetration and air content control charts, record the individual measurements and superimpose the following action and suspension limits:

**Penetration and Air Content Action and Suspension Limits**

Control Parameter	Individual Measurements	
	Action Limit	Suspension Limit
Penetration, CT 533	1 inch	1-1/2 inch
Air content, CT 504	±1.0 percent	±1.5 percent

**40-1.03D Contractor's Laboratory**

Use a laboratory that complies with ASTM C 1077 to determine the mix proportions for concrete pavement. The laboratory must have a current AASHTO accreditation for:

1. AASHTO T 97 or ASTM C 78

## 2. ASTM C 192/C 192M

### **40-1.03E Joint Sealant and Compression Seal Installation Training**

Before installing joint sealant or compression seals, arrange for a representative from the joint sealant or compression seal manufacturer to provide training on the cleaning and preparation of the joint and installing the sealant or seal. Until your personnel and the Department's personnel have been trained, do not install joint sealant or compression seals.

### **40-1.03F Frequency Measuring Device (Tachometer)**

Before each day's concrete pavement placement and at intervals not to exceed 4 hours of production, test and record vibration frequency for concrete consolidation vibrators.

### **40-1.03G Early Age Concrete Pavement Crack Mitigation System**

Develop and implement a system for predicting concrete pavement stresses and strength during the initial 72 hours after paving. The system must include:

1. Subscribing to a weather service to obtain forecasts for wind speed, ambient temperatures, humidity, and cloud cover
2. Portable weather station with anemometer, temperature and humidity sensors, located at the paving site
3. Early age concrete pavement stress and strength prediction computer program
4. Analyzing, monitoring, updating, and reporting the system's predictions

### **40-1.03H Curing Compound**

Sample curing compound from shipping containers at the manufacturer's source of supply. Split the samples.

### **40-1.03I Concrete Pavement Smoothness**

Within 10 days after paving, measure the Profile Index ( $PI_0$ ) of the concrete pavement surface using a zero (null) blanking band under California Test 526.

For the following concrete pavement areas, the Engineer does not require a profilograph and you must test and correct high points determined by a 12-foot straightedge placed parallel with and perpendicular to the centerline:

1. Horizontal curves with a centerline radius of curvature less than 1,000 feet including concrete pavement within the superelevation transitions of those curves.
2. Exit ramp termini, truck weigh stations, and weigh-in-motion areas
3. Where steep grades and superelevation rates greater than 6 percent are present on:
  - 3.1. Ramps
  - 3.2. Connectors
4. Turn lanes and areas around manholes or drainage transitions
5. Acceleration and deceleration lanes for at-grade intersections
6. Shoulders and miscellaneous gore areas

Use a California Profilograph or equivalent to determine the concrete pavement profile. If the profilograph uses a mechanical recorder, use an electronic scanner to reduce the profilogram.

The profilograph operator must be qualified under the Department's Independent Assurance Manual. The manual is available from the Transportation Laboratory.

### **40-1.03J Profilograph Test Procedure**

Notify the Engineer at least 2 business days before performing profilograph testing. Each day before performing profilograph testing, notify the Engineer of the start location. Perform profilograph testing in the Engineer's presence.

Before starting profilograph testing, remove foreign objects from the concrete pavement surface.

Before starting profilograph testing, calibrate the profilograph in the Engineer's presence. If the Engineer chooses not to be present during profilograph testing, you may perform the testing with the Engineer's written approval. Note the Engineer's absence on the profilogram.

Determine  $PI_0$  values for the final concrete pavement surface of each 0.1-mile section of a traffic lane. Take 2 profiles within each traffic lane, 3 feet from and parallel with the edge of each lane. Each section's  $PI_0$  is the average of the  $PI_0$  values for the measurements within that traffic lane. A section that is less than 0.01 mile and is the result of an interruption to

continuous concrete pavement surface must comply with the PI<sub>0</sub> specifications for a full section. Adjust the PI<sub>0</sub> for a partial section to reflect a full section.

Use stationing to locate vertical deviations greater than 0.3 inches. The profilogram stationing must be the same as the project stationing. Note 0.1-mile segments on the profilogram.

Label the profilogram with:

1. Contract number
2. County and route number
3. Stationing
4. Operator's name
5. Test date
6. Test number
7. Traffic direction
8. Traffic lane (numbered from left to right in direction of travel)
9. Test wheel path (left or right in direction of travel)
10. Test direction
11. Paving direction

**40-1.03K Smoothness Corrective Action**

Correct concrete pavement not complying with the Engineer's acceptance specifications for smoothness by grinding under Section 42-2, "Grinding."

Do not grind before:

1. Ten days after concrete pavement placement
2. The concrete has developed a modulus of rupture of at least 550 psi

Grind the entire lane width. When completed, the lane width must be uniform in texture and appearance. Square the corrected area's start and end normal to the paved surface's centerline.

Retest sections where corrections were made.

**40-1.03L Engineer's Acceptance**

**General**

The Engineer accepts concrete pavement based on the Department's testing for the following concrete pavement quality characteristics. A single test represents no more than the quantity specified:

**Concrete Pavement Acceptance**

Quality Characteristic	Quantity	Test
28-day modulus of rupture	1,000 cubic yards	CT 523
Thickness	1,200 square yards for primary area measurements	CT 531
Dowel bar placement	700 square yards	Measurement
Tie bar placement	4,000 square yards	Measurement
Coefficient of friction	One day's paving	CT 342
Air content (freeze-thaw) <sup>a</sup>	One day's paving	CT 504

Note:

<sup>a</sup> Air content tests must be performed under California Test 504 if air entrainment is specified.

At the Department's option, the Engineer also accepts concrete pavement based on your or the Department's testing for smoothness. A single test represents no more than 0.1 mile.

The Engineer considers other concrete pavement quality characteristics in determining final acceptance. The Engineer's acceptance of modulus of rupture, thickness, dowel bar and tie bar placement, coefficient of friction, smoothness, and air content does not constitute final concrete pavement acceptance.

**Modulus of Rupture**

The Engineer accepts concrete pavement for modulus of rupture on a lot basis. The minimum modulus of rupture for each lot is 570 psi at 28 days.

For each lot of concrete for concrete pavement:

1. Quantity must not exceed 1,000 cubic yards.
2. Department determines the modulus of rupture of test beams aged 10 days and 28 days.
3. Department calculates the modulus of rupture by averaging the individual test results of 2 beams aged for 28 days.
4. Difference in the individual test results of beams aged 28 days must not exceed 12 percent when tested by Method 1, or 16 percent when tested by Method 2. The Engineer calculates the difference relative to the average of the 2 test results.

The Department provides molds and machines for modulus of rupture acceptance testing. Provide material and labor the Engineer may require.

### **Concrete Pavement Smoothness**

If the Department tests for smoothness, the tests are performed under Section 40-1.03I, "Concrete Pavement Smoothness."

The Engineer accepts concrete pavement for smoothness in compliance with the following:

1. For tangents and horizontal curves having a centerline radius of curvature 2,000 feet or more, the  $PI_0$  must be at most 3 inches per 0.1-mile section.
2. For horizontal curves having a centerline radius of curvature from 1,000 to 2,000 feet including concrete pavement within the superelevation transitions of those curves, the  $PI_0$  must be at most 6 inches per 0.1-mile section.
3. If using a profilograph to measure smoothness, the surface must not have individual high points greater than 0.3 inch.
4. If using a straightedge to measure smoothness, the surface must be within 0.02 foot of the straightedge's lower edge.

Profile index specifications apply to existing pavement within 50 feet of the transverse joint separating new concrete pavement and the existing pavement.

If the Department's profilograph test results do not match yours, the Engineer may order you to recalibrate your profilograph equipment and perform a retest. If your test results are inaccurate due to operator error, the Engineer may disqualify your profilograph operator. If the Engineer determines your test results are inaccurate, the Engineer does not make adjustments to payment or contract time for recalibrating, retesting, and delays.

### **Concrete Pavement Thickness**

The Engineer accepts concrete pavement for thickness based on coring in the primary area, which is the area placed in 1 day for each thickness. Concrete pavement thickness must not be deficient by more than 0.05 foot.

After corrective grinding has been completed, core concrete pavement in the primary area under Section 40-3.16, "Obtaining Drilled Cores," at locations determined by the Engineer and in the Engineer's presence. The core specimen diameter must be 4 inches. To identify the limits of concrete pavement deficient in thickness by more than 0.05 foot, you may divide primary areas into secondary areas. Specifications that may affect concrete pavement thickness such as allowable tolerances for subgrade construction do not change the thickness specified for concrete pavement.

In each primary area, the Engineer measures concrete pavement thickness every 1,200 square yards and any remaining area. The Engineer measures cores under California Test 531 to the nearest 0.01 foot. Core at least 1 foot from existing, contiguous, and parallel concrete pavement not constructed as part of this contract.

You may request the Engineer make additional thickness measurements and use them to determine the average thickness variation. The Engineer determines the locations with random sampling methods.

If each thickness measurement in a primary area is less than 0.05 foot deficient, the Engineer calculates the average thickness deficiency in that primary area. The Engineer uses 0.02 foot for a thickness difference more than 0.02 foot over the specified thickness.

For each thickness measurement in a primary area deficient by more than 0.05 foot, the Engineer determines a secondary area where the thickness deficiency is more than 0.05 foot. The Engineer determines this secondary area by measuring the thickness of each concrete pavement slab adjacent to the measurement found to be more than 0.05 foot deficient. The Engineer continues to measure the thickness until an area that is bound by slabs with thickness deficient by 0.05 foot or less is determined.

Slabs without bar reinforcement are defined as the areas bound by longitudinal and transverse joints and concrete pavement edges. Slabs with bar reinforcement are defined as the areas bound by longitudinal joints and concrete pavement edges and 15-foot lengths. Secondary area thickness measurements in a slab determine that entire slab's thickness.

The Engineer measures the remaining primary area thickness after removing the secondary areas from consideration for determining the average thickness deficiency.

The Engineer determines the slabs to remove and replace.

### Required Use of Air-Entraining Admixtures

If air-entraining admixtures are specified, the Engineer may choose to accept concrete pavement for air content based on your air content quality control tests. The Engineer decides to use your air content quality control tests based on a  $t$ -test that determines the difference in the means of your test and the Engineer's verification tests. The Engineer calculates the  $t$ -value of the test data as follows:

$$t = \frac{|\bar{X}_c - \bar{X}_v|}{S_p \sqrt{\frac{1}{n_c} + \frac{1}{n_v}}} \quad \text{and} \quad S_p^2 = \frac{S_c^2(n_c - 1) + S_v^2(n_v - 1)}{n_c + n_v - 2}$$

where:

- $n_c$  = Number of your quality control tests (minimum of 2 required)
- $n_v$  = Number of verification tests (minimum of 1 required)
- $\bar{X}_c$  = Mean of your quality control tests
- $\bar{X}_v$  = Mean of the verification tests
- $S_p$  = Pooled standard deviation  
(When  $n_v = 1$ ,  $S_p = S_c$ )
- $S_c$  = Standard deviation of your quality control tests
- $S_v$  = Standard deviation of the verification tests (when  $n_v > 1$ )

The Engineer compares your quality control test results with the Department's verification test results at a level of significance of  $\alpha = 0.01$ . The Engineer compares the  $t$ -value to  $t_{crit}$ , determined from:

$t_{crit}$	
degrees of freedom ( $n_c + n_v - 2$ )	$t_{crit}$ (for $\alpha = 0.01$ )
1	63.657
2	9.925
3	5.841
4	4.604
5	4.032
6	3.707
7	3.499
8	3.355
9	3.250
10	3.169

If the  $t$ -value calculated is less than or equal to  $t_{crit}$ , your quality control test results are verified. If the  $t$ -value calculated is greater than  $t_{crit}$ , quality control test results are not verified.

If your quality control test results are not verified, core at least 3 specimens from concrete pavement under Section 40-3.16, "Obtaining Drilled Cores." The Engineer selects the core locations. Your approved third party independent testing laboratory must test these specimens for air content under ASTM C 457. The Engineer compares these test results with your quality control test results using the  $t$ -test method. If your quality control test results are verified based on this comparison, the Engineer uses the quality control test results for acceptance of concrete pavement for air content. If your quality control test results are not verified based on this comparison, the Engineer uses the air content of core specimens determined under ASTM C 457 for acceptance.

### Dowel Bar and Tie Bar Placement

The Engineer uses core specimens to evaluate and accept concrete pavement for:

1. Dowel bar placement
2. Tie bar placement
3. Concrete consolidation

Obtain cores under Section 40-3.16, "Obtaining Drilled Cores." The Engineer determines the core locations. Each core must have a nominal diameter of 4 inches. Core each day's paving within 2 business days in compliance with:

1. One test for every 700 square yards of doweled concrete pavement or remaining fraction of that area. Each dowel bar test consists of 2 cores, 1 on each dowel bar end to expose both ends and allow measurement.
2. One test for every 4,000 square yards of concrete pavement with tie bars or remaining fraction of that area

If the tests indicate dowel or tie bars are not placed within the specified tolerances or if there are air voids around the dowel or tie bars, core additional specimens to determine the limits of unacceptable work.

The Engineer determines the slabs to remove and replace.

If the Engineer approves your request, slabs may remain in place with an adjustment in payment for:

1. Dowel bars with centers from  $\pm 2$  inches to  $\pm 3$  inches from the saw cut of a transverse contraction joint or with deficient concrete consolidation around the dowel bars
2. Tie bars placed outside their specified placement and position or with deficient concrete consolidation around the tie bars

### **Bar Reinforcing Steel**

The Engineer accepts concrete pavement for bar reinforcing steel based on inspection before concrete placement.

### **Curing Compound**

Curing compound sampled from shipping containers from the manufacturer's supply source or from the job site must match the test results for viscosity, nonvolatile content, and pigment content within the specified tolerances listed in the precision and bias statements for the test methods.

## **40-2 MATERIALS**

### **40-2.01 CONCRETE**

#### **40-2.01A General**

Concrete must comply with Section 90, "Portland Cement Concrete."

#### **40-2.01B Aggregate**

The specifications for reduction in Operating Range and Contract Compliance for cleanness value and sand equivalent specified under Section 90-2.02A, "Coarse Aggregate," and Section 90-2.02B, "Fine Aggregate," do not apply to concrete pavement.

Combined aggregate gradings must comply with Section 90-3, "Aggregate Gradings," and the difference between the percent passing the 3/8-inch sieve and the percent passing the No. 8 sieve must not be less than 16 percent of the total aggregate.

#### **40-2.01C Cementitious Material**

Concrete for concrete pavement must contain from 505 pounds to 675 pounds cementitious material per cubic yard. The specifications for reducing cementitious material content in Section 90-4.05, "Optional Use of Chemical Admixtures," do not apply to concrete pavement.

#### **40-2.01D Mix Proportions**

Your laboratory determining mix proportions must determine the minimum cementitious materials content or the maximum water to cementitious materials ratio under California Test 559 and:

1. You must make trial mixtures no more than 24 months before field qualification.
2. Modulus of rupture used to determine the minimum cementitious materials content or maximum water to cementitious materials ratio must be 570 psi at 28 days age and 650 psi at 42 days age.
3. Your laboratory must determine an increase in the cementitious materials content or a decrease in the water to cementitious materials ratio from the trial mixtures to ensure concrete pavement complies with the specifications.

If changing an aggregate supply source or the mix proportions, produce a trial batch and field-qualify the new concrete. The Engineer does not adjust contract time for performing sampling, testing, and qualifying new mix proportions or changing an aggregate supply source.

#### **40-2.01E Field Qualification**

Proposed mix proportions must be field qualified before you place concrete pavement. Use an American Concrete Institute (ACI) certified "Concrete Laboratory Technician, Grade I" to perform field qualification tests and calculations.

The Engineer accepts field qualification if five beams made and tested under California Test 523 comply with the following:

1. At a minimum, beams are tested at 10, 21, and 28 days of age
2. At your choice of age not later than 28 days, no single beam's modulus of rupture is less than 550 psi and the average modulus of rupture is at least 570 psi

#### **40-2.02 TIE BARS**

Tie bars must be one of the following:

1. Epoxy-coated steel reinforcing bar. Bar reinforcing must comply with either ASTM A 615/A 615M, Grade 40 or 60; ASTM A 996/A 996M; or ASTM A 706/A 706M. Epoxy coating must comply with Section 52-1.02B, "Epoxy-coated Reinforcement."
2. Stainless-steel bar. Stainless-steel bar must be descaled, pickled, and polished solid stainless-steel bars UNS Designation S31603 or S31803, Grade 60 under ASTM A 955/A 955M.
3. Low carbon, chromium-steel bar. Low carbon, chromium-steel bar must comply with ASTM A 1035/A 1035M.

Fabricate, sample, and handle epoxy-coated deformed tie bars at the job site under ASTM D 3963/D 3963M and Section 52-1.02B, "Epoxy-coated Reinforcement."

Do not bend epoxy-coated tie bars.

#### **40-2.03 DOWEL BARS**

##### **40-2.03A General**

Dowel bars must be plain steel bars and one of the following:

1. Epoxy-coated bar. Epoxy bars must comply with ASTM A 615/A 615M, Grade 40 or 60. Epoxy coating must comply with Section 52-1.02B, "Epoxy-coated Reinforcement."
2. Stainless-steel bar. Stainless-steel bars must be descaled, pickled, and polished solid stainless-steel bars, UNS Designation S31603 or S31803, Grade 60 under ASTM A 276/A 276M, and ASTM A 955/A 955M.
3. Low carbon, chromium-steel bars. Low carbon, chromium-steel bars must comply with ASTM A 1035/A 1035M.

Fabricate, sample, and handle epoxy-coated dowel bars at the job site under ASTM D 3963/D 3963M and Section 52-1.02B, "Epoxy-coated Reinforcement," except each sample must be 18 inches long. Sample each load delivered to the job site.

##### **40-2.03B Dowel Bar Lubricant**

Dowel bar lubricant must be petroleum paraffin-based or curing compound. Paraffin-based lubricant must be Dayton Superior DSC BB-Coat or Valvoline Tectyl 506 or an approved equal and must be factory-applied. Curing compound must be curing compound (3) under Section 90-7.01B, "Curing Compound Method," of the Standard Specifications.

#### **40-2.04 CURING COMPOUND**

Curing compound must be curing compound (1) or (2) with white pigment under Section 90-7.01B, "Curing Compound Method."

Reflectance must be at least 60 percent when tested under ASTM E 1347.

#### **40-2.05 CHEMICAL ADHESIVE (DRILL AND BOND)**

Chemical adhesive for drilling and bonding dowels and tie bars must be prequalified. A list of prequalified chemical adhesives is available on the Department's Materials Engineering and Testing Services website. The prequalified list indicates the appropriate chemical adhesive system for the concrete temperature and installation conditions.

Each chemical adhesive system must clearly and permanently show the manufacturer's name, model number of the system, manufacturing date, lot number, shelf life or expiration date, and current International Conference of Building

Officials (ICBO) Evaluation Report number. Each chemical adhesive carton must include the manufacturer's recommended installation procedures and warning or precautions required by State or Federal laws and regulations.

#### 40-2.06 DOWEL AND TIE BAR BASKETS

Dowel and tie bar baskets must be:

1. Minimum W10 wire size number under ASTM A 82/A 82M
2. Either U-frame or A-frame shape
3. Welded under Section 7.4 of ASTM A 185/A 185M

You may epoxy-coat dowel and tie bar baskets under Section 52-1.02B, "Epoxy-coated Reinforcement," and the following:

1. Epoxy-coated dowel and tie bar baskets must comply with ASTM A 884/A 884M, Class A, Type 1 or Type 2.
2. Epoxy-coating under ASTM A 884/ A 884M, Class A, Type 2 must be purple or gray.

If tie bars or dowel bars are stainless steel, tie bar and dowel bar baskets must be stainless steel.

If tie bars or dowel bars are low carbon, chromuim-steel, tie bar or dowel bar baskets must comply with ASTM A 1035/A 1035M.

Handle epoxy-coated dowel and tie-bar baskets at the manufacturing plant and job site under ASTM D 3963/D 3963M and Section 52-1.02B, "Epoxy-coated Reinforcement."

Fasteners must be driven fasteners under ASTM F 1667. Fasteners on lean concrete base or asphalt concrete must have a minimum shank diameter of 3/16 inch and a minimum shank length of 2 1/2 inches. For asphalt treated permeable base or cement treated permeable base, the shank diameter must be at least 3/16 inch and the shank length must be at least 5 inches.

Fasteners, clips, and washers must have a minimum 0.2-mil thick zinc coating applied either by electroplating or galvanizing.

#### 40-2.07 BACKER RODS

Backer rods must be Type 1 under ASTM D 5249. Backer rod diameter must be at least 25 percent greater than the sawcut joint width. Backer rod material must be expanded, crosslinked, closed-cell polyethylene foam. No bond or adverse reaction may occur between the backer rod and sealant.

#### 40-2.08 JOINT FILLER MATERIAL

Joint filler for isolation joints must be preformed expansion joint filler for concrete (bituminous type) under ASTM D 994.

#### 40-2.09 HYDRAULIC CEMENT GROUT (NON-SHRINK)

Hydraulic cement grout (non-shrink) must comply with ASTM C 1107/ C 1107M. Use clean, uniform, rounded aggregate filler to extend the grout. Aggregate filler must not exceed 60 percent of the grout mass or the maximum recommended by the manufacturer, whichever is less. Aggregate filler moisture content must not exceed 0.5 percent. Aggregate filler must comply with:

**Aggregate Filler Grading**

Sieve Size	Percentage Passing
1/2-inch	100
3/8-inch	85 - 100
No. 4	10 - 30
No. 8	0 - 10
No. 16	0 - 5

#### 40-2.10 BAR REINFORCEMENT

Bar reinforcement must comply with Section 52, "Reinforcement."

#### 40-2.11 JOINT SEALANT

##### 40-2.11A General

Do not use hot-pour sealant that will melt the backer rod.

**40-2.11B Silicone Joint Sealant**

Silicone joint sealant must be low modulus furnished in a one-part silicone formulation. Do not use acid cure sealant. Silicone joint sealant must be compatible with the surface it is applied to and comply with:

**Silicone Joint Sealant**

Property	Test Method	Specification
Tensile stress, 150% elongation, 7-day cure at 77 °F ± 2 °F and 45% to 55% R.H. °	ASTM D 412 (Die C)	45 psi max.
Flow at 77 °F ± °F	ASTM C 639 <sup>a</sup>	Must not flow from channel
Extrusion Rate at 77 °F ± 2 °F	ASTM C 603 <sup>b</sup>	3 to 9 oz/min.
Specific Gravity	ASTM D 792 Method A	1.01 to 1.51
Durometer Hardness, at 0 °F, Shore A, cured 7 days at 77 °F ±2 °F	ASTM C 661	10 to 25
Ozone and Ultraviolet Resistance, after 5,000 hours	ASTM C 793	No chalking, cracking or bond loss
Tack-free at 77 °F ±2 °F and 45% to 55% R.H.°	ASTM C 679	Less than 75 minutes
Elongation, 7 day cure at 77 °F ±2 °F and 45% to 55% R.H. °	ASTM D 412 (Die C)	500 percent min.
Set to Touch, at 77 °F ±2 °F and 45% to 55% R.H. °	ASTM D 1640	Less than 75 minutes
Shelf Life, from date of shipment	—	6 months min.
Bond, to concrete mortar-concrete briquettes, air cured 7 days at 77 °F ±2 °F	AASHTO T 132 <sup>c</sup>	50 psi min.
Movement Capability and Adhesion, 100% extension at 0 °F after, air cured 7 days at 77 °F ±2 °F , and followed by 7 days in water at 77 °F ±2 °F	ASTM C 719 <sup>d</sup>	No adhesive or cohesive failure after 5 cycles

Notes:

<sup>a</sup> ASTM C 639 Modified (15 percent slope channel A).

<sup>b</sup> ASTM C 603, through 0.12-inch opening at 50 psi.

<sup>c</sup> Mold briquettes under AASHTO T 132, saw in half and bond with a 0.60-inch maximum thickness of sealant and test under AASHTO T 132. Briquettes must be dried to constant mass at 212 °F ±10 °F.

<sup>d</sup> Prepare 12" x 1" x 3" concrete blocks under ASTM C 719. Use a sawed face for bond surface. Seal 2 inches of block leaving 0.50 inch on each end of specimen unsealed. The depth of sealant must be 0.40 inch and the width 0.50 inch.

<sup>e</sup> R.H. equals relative humidity.

After application, silicone joint sealant must not flow on grades up to 15 percent.

**40-2.11C Asphalt Rubber Joint Sealant**

Asphalt rubber joint sealant must:

1. Be a mixture of paving asphalt and ground rubber containing not less than 22 percent ground rubber by weight. One hundred percent of ground rubber must pass a No. 8 sieve. Ground rubber must be vulcanized or a combination of vulcanized and devulcanized materials.
2. Comply with ASTM D 6690, Type II except:
  - 2.1. The cone penetration requirement must not exceed 120 at 77 F, 5 ounces, 5 seconds.
  - 2.2. The resilience requirement must be a minimum 50 percent recovery when tested at 77 F.
3. Have a Ring and Ball softening point of 135 °F minimum when tested under AASHTO T 53.
4. Be capable of being melted and applied to cracks and joints at temperatures below 400 °F.
5. Not be applied when the concrete pavement surface temperature is below 50 °F.

**40-2.11D Preformed Compression Joint Seals**

Preformed compression joint seals must comply with ASTM D 2628. Lubricant adhesive used with the seals must comply with ASTM D 2835. Preformed compression joint seals must have 5 or 6 cells, except seals for Type A2 and Type B

joints may have 4 cells. Install preformed compression joint seals in compliance with the manufacturer's recommendations. Show evidence that the seals are compressed from 40 to 50 percent for the joint width and depth.

#### **40-2.12 WATER**

Water for core drilling must be from a local domestic water supply. Water must not contain:

1. More than 1,000 parts per million of chlorides as CL
2. More than 1,300 parts per million of sulfates as SO<sub>4</sub>
3. Impurities in a quantity to cause concrete discoloration or surface etching

### **40-3 CONSTRUCTION**

#### **40-3.01 WATER SUPPLY**

Before placing concrete pavement, develop enough water supply for the work.

#### **40-3.02 SUBGRADE PREPARATION**

Immediately before placing concrete, the subgrade to receive concrete pavement must be:

1. In compliance with the specified compaction and elevation tolerances
2. Free of loose and extraneous material
3. Uniformly moist, but free of standing or flowing water
4. Excavated for thickened parts of concrete pavement end anchors with no disturbed compaction outside the end anchor dimensions

If cement treated permeable base is specified, cover the base surface with asphaltic emulsion before placing concrete pavement. Apply the asphaltic emulsion uniformly at a rate of 0.1 gallons per square yard. Asphaltic emulsion must comply with anionic slow-setting type, SS1h grade in Section 94, "Asphaltic Emulsions." Repair damaged asphaltic emulsion before placing concrete pavement.

#### **40-3.03 PROPORTIONING**

Proportion aggregate and bulk cementitious materials under Section 90-5, "Proportioning."

#### **40-3.04 PLACING CONCRETE**

##### **40-3.04A General**

Place concrete pavement with stationary side forms or slip-form paving equipment.

Place consecutive concrete loads within 30 minutes of each other. Construct a transverse construction joint when concrete placement is interrupted by more than 30 minutes. The transverse construction joint must coincide with the next contraction joint location, or you must remove fresh concrete pavement to the preceding transverse joint location.

Place concrete pavement in full slab widths separated by construction joints or monolithically in multiples of full lane widths with a longitudinal contraction joint at each traffic lane line.

Do not retemper concrete.

If the concrete pavement surface width is constructed as specified, you may construct concrete pavement sides on a batter not flatter than 6:1 (vertical:horizontal).

##### **40-3.04B Concrete Pavement Widening**

If concrete pavement is placed adjacent to existing pavement not constructed as part of the contract, grind the existing concrete pavement lane or shoulder adjacent to the new concrete pavement. Perform the grinding before new concrete pavement is placed. The new concrete pavement must match the elevation of the existing concrete pavement after grinding. Grind existing concrete pavement under Section 42-2, "Grinding," except profile index must comply with the pavement smoothness specifications in Section 40-1.03, "Quality Control and Assurance."

Use paving equipment with padded crawler tracks or rubber-tired wheels on the existing concrete pavement with enough offset to avoid breaking or cracking the existing concrete pavement's edge.

##### **40-3.04C Concrete Pavement Transition Panel**

For concrete pavement placed in a transition panel, texture the surface with a drag strip of burlap, a broom, or a spring steel tine device that produces scoring in the finished surface. The scoring must be either parallel with or transverse to the centerline. For the method you choose, texture at the time that produces the coarsest texture.

#### **40-3.04D Stationary Side Form Construction**

Stationary side forms must be straight and without defects including warps, bends, and indentations. Side forms must be metal except at end closures and transverse construction joints where other materials may be used.

You may build up side forms by attaching a section to the top or bottom. If attached to the top of metal forms, the attached section must be metal.

The side form's base width must be at least 80 percent of the specified concrete pavement thickness.

Side forms including interlocking connections with adjoining forms must be rigid enough to prevent springing from subgrading and paving equipment and concrete pressure.

Construct subgrade to final grade before placing side forms. Side forms must bear fully on the foundation throughout their length and base width. Place side forms to the specified grade and alignment of the finished concrete pavement's edge. Support side forms during concrete placing, compacting, and finishing.

After subgrade work is complete and immediately before placing concrete, true side forms and set to line and grade for a distance that avoids delays due to form adjustment.

Clean and oil side forms before each use.

Side forms must remain in place for at least 1 day after placing concrete and until the concrete pavement edge no longer requires protection from the forms.

Spread, screed, shape, and consolidate concrete with 1 or more machines. The machine must uniformly distribute and consolidate the concrete. The machines must operate to place the concrete pavement to the specified cross section with minimal hand work.

Consolidate the concrete without segregation. If vibrators are used:

1. The vibration rate must be at least 3,500 cycles per minute for surface vibrators and 5,000 cycles per minute for internal vibrators
2. Amplitude of vibration must cause perceptible concrete surface movement at least 1 foot from the vibrating element
3. Use a calibrated tachometer for measuring frequency of vibration
4. Vibrators must not rest on side forms or new concrete pavement
5. Power to vibrators must automatically cease when forward or backward motion of the paving machine is stopped

Use high-frequency internal vibrators within 15 minutes of depositing concrete on the subgrade to uniformly consolidate the concrete across the paving width including adjacent to forms. Do not use vibrators to shift the mass of concrete.

#### **40-3.04E Slip-Form Construction**

If slip-form construction is used, spread, screed, shape, and consolidate concrete to the specified cross section with slip-form machines and minimal hand work. Slip-form paving machines must be equipped with traveling side forms and must not segregate the concrete.

Do not deviate from the specified concrete pavement alignment by more than 0.1 foot.

Slip-form paving machines must use high frequency internal vibrators to consolidate concrete. You may mount vibrators with their axes parallel or normal to the concrete pavement alignment. If mounted with axes parallel to the concrete pavement alignment, space vibrators no more than 2.5 feet measured center to center. If mounted with axes normal to the concrete pavement alignment, space the vibrators with a maximum 0.5-foot lateral clearance between individual vibrators.

Each vibrator must have a vibration rate from 5,000 cycles per minute to 8,000 cycles per minute. The amplitude of vibration must cause perceptible concrete surface movement at least 1 foot from the vibrating element. Use a calibrated tachometer to measure frequency of vibration.

#### **40-3.05 TIE BAR PLACEMENT**

Place tie bars perpendicular to the longitudinal concrete pavement joint and parallel with the concrete pavement surface at mid-slab depth with the following tolerances:

1. Not less than 1/2-inch below the saw cut depth of joints
2. With not less than 2 inches clearance from the concrete pavement's surface and bottom
3. With embedment length tolerance of  $\pm 2$  inches

Install tie bars at longitudinal joints by 1 of the following methods:

1. Drill concrete and bond tie bars with chemical adhesive in compliance with the manufacturer's instructions. Clean and dry drilled holes before placing chemical adhesive and tie bars. After inserting tie bars into chemical adhesive, support the bars to prevent movement during curing. If the Engineer rejects a tie bar installation, cut the tie bar flush

with the joint face and coat the exposed end of the tie bar with chemical adhesive under Section 40-2, "Materials." Offset new holes 3 inches horizontally from the rejected hole's center.

2. Insert tie bars into plastic slip-formed concrete before finishing. Inserted tie bars must have full contact between the bar and the concrete. If tie bars are inserted through the plastic concrete surface, eliminate evidence of the insertion by reworking the concrete over the tie bars.
3. Use threaded tie bar splice couplers fabricated from deformed bar reinforcement free of external welding or machining.
4. Use tie bar baskets. Anchor baskets at least 200 feet in advance of the concrete placement activity. If you request a waiver, describe the construction limitations or restricted access preventing the advanced anchoring. After the baskets are anchored and before the concrete is placed, cut and remove temporary spacer wires and demonstrate the tie bars do not move from their specified depth and alignment during concrete placement. Use fasteners to anchor tie bar baskets.

If tie bars are not placed correctly, stop paving activities until you demonstrate to the Engineer correction of the cause.

#### 40-3.06 DOWEL BAR PLACEMENT

Center dowel bars within 2 inches in the longitudinal direction on transverse contraction joints or construction joints.

If using curing compound as lubricant, apply the curing compound to dowels in 2 separate applications. Lubricate each dowel bar entirely with bond breaker before placement. The last application must be applied not more than 8 hours before placing the dowel bars. Apply each curing compound application at a rate of 1 gallon per 150 square feet.

If dowel bars are placed by mechanical insertion, eliminate evidence of the insertion by reworking the concrete over the dowel bars. If drilling and bonding dowel bars at construction joints, use a grout retention ring.

If using dowel bar baskets, anchor them with fasteners.

Use at least 10 fasteners for basket sections greater than 12 feet and less than or equal to 16 feet. Baskets must be anchored at least 200 feet in advance of the concrete placement activity unless the Engineer approves your waiver request. If requesting a waiver, describe the construction limitations or restricted access preventing the advanced anchoring. After the baskets are anchored and before the concrete is placed, cut and remove temporary spacer wires and demonstrate the dowel bars do not move from their specified depth and alignment during concrete placement.

Place dowel bars in compliance with:

**Dowel Bar Tolerances**

Dimension	Tolerance
Horizontal offset	±1 inch
Longitudinal translation	±2 inches
Horizontal skew	3/8 inch, max
Vertical skew	3/8 inch, max
Vertical depth	<p>The minimum distance below the concrete pavement surface must be:</p> $DB = d/3 + 1/2 \text{ inch}$ <p>where:            DB = vertical distance in inches, measured from concrete pavement surface to any point along the top of dowel bar            d = concrete pavement thickness in inches</p> <p>The maximum distance below the depth shown on the plans must be 0.05 foot.</p>

If dowel bars are not placed correctly, stop paving activities until you demonstrate to the Engineer correction of the cause.

Remove and replace the concrete pavement 3 feet on either side of a joint with a rejected dowel bar.

#### **40-3.07 BAR REINFORCEMENT**

Place bar reinforcement under Section 52, "Reinforcement." Bar reinforcement must be more than 1/2 inch below the saw cut depth at concrete pavement joints.

#### **40-3.08 JOINTS**

##### **40-3.08A General**

Concrete pavement joints consist of:

1. Longitudinal and transverse construction joints
2. Longitudinal and transverse contraction joints
3. Isolation joints

Construction joints must be normal to the concrete pavement surface.

Until contract acceptance and except for joint filler material, keep joints free of foreign material including soil, gravel, concrete, or asphalt mix.

Volunteer cracks are cracks not coincident with constructed joints.

Repair concrete pavement damaged during joint construction under Section 40-3.17B, "Repair of Spalls, Raveling, and Tearing."

Do not bend tie bars or reinforcement in existing concrete pavement joints.

##### **40-3.08B Construction Joints**

Construction joints form where fresh concrete is placed against hardened concrete, existing pavements, or structures.

Before placing concrete at construction joints, apply a curing compound under Section 90-7.01B, "Curing Compound Method," to the vertical surface of existing or hardened concrete and allow it to dry.

Use a metal or wooden bulkhead to form transverse construction joints. If dowel bars are specified, the bulkhead must allow dowel bar installation.

##### **40-3.08C Contraction Joints**

In multilane monolithic concrete pavement, use the sawing method to construct longitudinal contraction joints. Construct transverse contraction joints by the sawing method.

Construct transverse contraction joints within 1 foot of their specified spacing. If a slab length of less than 5 feet would be formed, adjust the transverse contraction joint spacing.

Construct transverse contraction joints across the full concrete pavement width regardless of the number or types of longitudinal joints crossed. In areas of converging and diverging pavements, space transverse contraction joints so their alignment is continuous across the full width where converging and diverging pavements are contiguous. Longitudinal contraction joints must be parallel with the concrete pavement centerline. Transverse and longitudinal contraction joints must not deviate by more than 0.1 foot from either side of a 12-foot straight line, except for longitudinal joints parallel to a curving centerline.

##### **40-3.08D Isolation Joints**

Construct isolation joints by saw cutting a minimum 1/8-inch width to full concrete pavement depth at the existing concrete pavement's edge and removing the concrete to expose a flat vertical surface. Before placing concrete, secure joint filler material that prevents new concrete from adhering to the existing concrete face.

Dispose of concrete saw cutting residue under Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way."

##### **40-3.08E Sawing Method**

The sawing method is cutting a groove in the concrete pavement with a power driven concrete saw. Grooves for longitudinal and transverse contraction joints must be the minimum width possible for the type of saw used. If necessary, the top of the joint must be sawn wider to provide space for joint sealant. Immediately wash slurry from the joint with water under 100 psi maximum pressure.

Saw longitudinal and transverse contraction joints before volunteer cracking occurs and after the concrete is hard enough to saw without spalling, raveling, or tearing.

To keep foreign material out of grooves before joint sealant or compression seal installation, you may use joint filler in sawed contraction joints. Joint filler must not react adversely with the concrete or cause concrete pavement damage. After sawing and washing a joint, install joint filler material that keeps moisture in the adjacent concrete during the 72 hours after paving. If you install joint filler material, the specifications for spraying the sawed joint with additional curing compound

under Section 40-3.13, "Curing," do not apply. If using absorptive filler material, moisten the filler immediately before or after installation.

### **40-3.09 JOINT SEALANT AND COMPRESSION SEAL INSTALLATION**

#### **40-3.09A General**

At least 7 days after concrete pavement placement and not more than 4 hours before installing joint sealant or compression seal materials, use dry sand blasting and other methods to clean the joint walls of objectionable material such as soil, asphalt, curing compound, paint, and rust. The maximum sand blasting nozzle diameter must be 1/4 inch. The minimum pressure must be 90 psi. Sand blast each side of the joint at least once, in at least 2 separate passes. Hold the nozzle at an angle to the joint from 1 to 2 inches from the concrete pavement. Using a vacuum, collect sand, dust, and loose material at least 2 inches on each side of the joint. Remove surface moisture and dampness at the joints with compressed air that may be moderately hot.

Before you install joint sealant or compression seal, the joint wall must be free of moisture, residue, or film.

If grinding or grooving over or adjacent to sealed joints, remove joint sealant or compression seal materials and dispose of them under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way." After grinding or grooving, replace the joint sealant or compression seal materials.

#### **40-3.09B Liquid Sealant**

Do not install liquid sealant in construction joints.

Install backer rods when the concrete pavement temperature is above the air dew point and when the air temperature is at least 40 °F.

Install liquid sealant immediately after installing the backer rod. Install sealant using a mechanical device with a nozzle shaped to introduce the sealant from inside the joint. Extrude sealant evenly and with continuous contact with the joint walls. Recess the sealant surface after placement. Remove excess sealant from the concrete pavement surface.

Do not allow traffic over sealed joints until the sealant is set.

#### **40-3.09C Preformed Compression Seal**

Do not install preformed compression seal in construction or isolation joints.

Install longitudinal seals before transverse seals. Longitudinal seals must be continuous except at intersections with transverse seals. Install transverse seals in 1 continuous piece for the entire transverse length of concrete pavement. With a sharp instrument, cut across the longitudinal seal at the intersection with transverse construction joints. If the longitudinal seal does not relax enough to properly install the transverse seal, trim the longitudinal seal to form a tight seal between the 2 joints.

Use a machine specifically designed for preformed compression seal installation. The machine must install the seal:

1. To the specified depth
2. To make continuous contact with the joint walls
3. Without cutting, nicking, or twisting the seal
4. With less than 4 percent stretch

Lay a length of preformed compression seal material cut to the exact length of the pavement joint to be sealed. The Engineer measures this length. After you install the length of preformed compression joint sealant, the Engineer measures the excess amount of material at the joint end. The Engineer divides the excess amount length by the original measured length to determine the percentage of stretch.

### **40-3.10 SHOULDER RUMBLE STRIP**

If specified, construct shoulder rumble strips by rolling or grinding indentations in new concrete pavement.

Select the method and equipment for constructing ground-in indentations.

Do not construct shoulder rumble strips on structures or approach slabs.

Construct rumble strips within 2 inches of the specified alignment. Roller or grinding equipment must be equipped with a sighting device enabling the operator to maintain the rumble strip alignment.

Indentations must not vary from the specified dimensions by more than 1/16 inch in depth or more than 10 percent in length and width.

The Engineer orders grinding or removal and replacement of noncompliant rumble strips to bring them within specified tolerances. Ground surface areas must be neat and uniform in appearance.

The grinding equipment must be equipped with a vacuum attachment to remove residue.

Dispose of removed material under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way."

## **40-3.11 PRELIMINARY FINISHING**

### **40-3.11A General**

Preliminary finishing must produce a smooth and true-to-grade finish. After preliminary finishing, mark each day's concrete pavement with a stamp. The stamp must be approved by the Engineer before paving starts. The stamp must be approximately 1' x 2' in size. The stamp must form a uniform mark from 1/8 to 1/4 inch deep. Locate the mark 20 feet ± 5 feet from the transverse construction joint formed at each day's start of paving and 1 foot ± 0.25 foot from the concrete pavement's outside edge. The stamp mark must show the month, day, and year of placement and the station of the transverse construction joint. Orient the stamp mark so it can be read from the concrete pavement's outside edge.

Do not apply more water to the concrete pavement surface than can evaporate before float finishing and texturing are completed.

Allow enough time to complete finishing activities during daylight. Work may continue after daylight if the Engineer approves lighting you provide.

### **40-3.11B Stationary Side Form Finishing**

If stationary side form construction is used, give the concrete a preliminary finish by the machine float method or the hand method.

If using the machine float method:

1. Use self-propelled machine floats.
2. Determine the number of machine floats required to perform the work at a rate equal to the concrete delivery rate. When the time from concrete placement to machine float finishing exceeds 30 minutes, stop concrete delivery. When machine floats are in proper position, you may resume concrete delivery and paving.
3. Machine floats must run on side forms or adjacent concrete pavement lanes. If running on adjacent concrete pavement, protect the adjacent concrete pavement surface under Section 40-3.15, "Protecting Concrete Pavement."
4. Floats must be hardwood, steel, or steel-shod wood. Floats must be equipped with devices that adjust the under side to a true flat surface.

If using the hand method, finish concrete smooth and true to grade with manually operated floats or powered finishing machines.

### **40-3.11C Slip-Form Finishing**

If slip-form construction is used, the slip-form paver must give the concrete pavement a preliminary finish. You may supplement the slip-form paver with machine floats.

Before the concrete hardens, correct concrete pavement edge slump in excess of 0.02 foot exclusive of edge rounding.

## **40-3.12 FINAL FINISHING**

After completing preliminary finishing, round the edges of the initial paving widths to a 0.04-foot radius. Round transverse and longitudinal construction joints to a 0.02-foot radius.

Before curing, texture the pavement. Perform initial texturing with a burlap drag or broom device that produces striations parallel to the centerline. Perform final texturing with a steel-tined device that produces grooves parallel with the centerline.

Construct longitudinal grooves with a self-propelled machine designed specifically for grooving and texturing concrete pavement. The machine must have tracks to maintain constant speed, provide traction, and maintain accurate tracking along the pavement surface. The machine must have a single row of rectangular spring steel tines. The tines must be from 3/32 to 1/8 inch wide, on 3/4-inch centers, and must have enough length, thickness, and resilience to form grooves approximately 3/16 inch wide. The machine must have horizontal and vertical controls. The machine must apply constant down pressure on the pavement surface during texturing. The machines must not cause ravels.

Construct grooves over the entire pavement width in a single pass except do not construct grooves 3 inches from the concrete pavement edges and longitudinal joints. Final texture must be uniform and smooth. Use a guide to properly align the grooves. Grooves must be parallel and aligned to the pavement edge across the pavement width. Grooves must be from 1/8 to 3/16 inch deep after concrete has hardened.

For irregular areas and areas inaccessible to the grooving machine, you may hand-construct grooves in compliance with the hand method under Section 40-3.11B, "Stationary Side Form Finishing." Hand-constructed grooves must comply with the specifications for machine-constructed grooves.

Initial and final texturing must produce a coefficient of friction of at least 0.30 when tested under California Test 342. Notify the Engineer when the concrete pavement is scheduled to be opened to traffic. Allow at least 25 days for the Department to test for coefficient of friction from the later of:

1. Seven days after concrete placement
2. When the concrete pavement has attained a modulus of rupture of 550 psi

Do not open the concrete pavement to traffic unless the coefficient of friction is at least 0.30.

Correct concrete pavement not complying with the Engineer's acceptance criteria for coefficient of friction by grooving or grinding under Section 42, "Groove and Grind Pavement."

Do not grind before:

1. Ten days after concrete pavement placement
2. Concrete has developed a modulus of rupture of at least 550 psi

Before opening to traffic, allow at least 25 days for the Department to retest sections for coefficient of friction after corrections are made.

#### **40-3.13 CURING**

Cure the concrete pavement's exposed area with waterproof membrane or curing compound (1) or (2) under Section 90-7.01, "Methods of Curing." When side forms are removed within 72 hours of the start of curing, also cure the concrete pavement edges.

If curing compound is used, apply it with mechanical sprayers. Reapply curing compound to sawcuts and disturbed areas.

#### **40-3.14 EARLY USE OF CONCRETE PAVEMENT**

If requesting early use of concrete pavement:

1. Furnish molds and machines for modulus of rupture testing
2. Sample concrete
3. Fabricate beam specimens
4. Test for modulus of rupture under California Test 523

When you request early use, concrete pavement must have a modulus of rupture of at least 350 psi. Protect concrete pavement under Section 40-3.15, "Protecting Concrete Pavement."

#### **40-3.15 PROTECTING CONCRETE PAVEMENT**

Protect concrete pavement under Section 90-8, "Protecting Concrete."

Maintain the concrete pavement temperature at not less than 40 °F for the initial 72 hours.

Protect the concrete pavement surface from activities that cause damage and reduce texture and coefficient of friction. Do not allow soil, gravel, petroleum products, concrete, or asphalt mixes on the concrete pavement surface.

Construct crossings for traffic convenience. If the Engineer approves your request, you may use Type III portland cement in the concrete for crossings. Do not open crossings until the Department determines by California Test 523 the concrete pavement's modulus of rupture is at least 550 psi.

Do not open concrete pavement to traffic or use equipment on the concrete pavement for 10 days after paving nor before the concrete has attained a modulus of rupture of 550 psi except:

1. If the equipment is for sawing contraction joints
2. If the Engineer approves your request, one side of paving equipment's tracks may be on the concrete pavement after a modulus of rupture of 350 psi has been attained, provided:
  - 2.1. Unit pressure exerted on the concrete pavement by the paver does not exceed 20 psi
  - 2.2. You change the paving equipment tracks to prevent damage or the paving equipment tracks travel on protective material such as planks
  - 2.3. No part of the track is closer than 1 foot from the concrete pavement's edge

If concrete pavement damage including visible cracking occurs, stop operating paving equipment on the concrete pavement and repair the damage.

#### **40-3.16 OBTAINING DRILLED CORES**

Drill concrete pavement cores under ASTM C 42/ C 42M. Core drilling equipment must use diamond impregnated bits.

Clean, dry, and fill core holes with hydraulic cement grout (non-shrink) or pavement concrete. Coat the core hole walls with epoxy under the specifications for epoxy adhesive for bonding new concrete to old concrete in Section 95, "Epoxy." The backfill must match the adjacent concrete pavement surface elevation and texture.

Do not allow residue from core drilling to fall on traffic, flow across shoulders or lanes occupied by traffic, or flow into drainage facilities including gutters.

#### **40-3.17 REPAIR, REMOVAL, AND REPLACEMENT**

##### **40-3.17A General**

Working cracks are full-depth cracks essentially parallel to a planned contraction joint beneath which a contraction crack has not formed. If the Engineer orders, take 4-inch nominal diameter cores on designated cracks under Section 40-3.16, "Obtaining Drilled Cores."

##### **40-3.17B Repair of Spalls, Raveling, and Tearing**

Before concrete pavement is open to traffic, repair spalls, raveling, and tearing in sawed joints. Make repairs in compliance with the following:

1. Saw a rectangular area with a diamond-impregnated blade at least 2 inches deep.
2. Remove unsound and damaged concrete between the saw cut and the joint and to the saw cut's depth. Do not use a pneumatic hammer heavier than 15 pounds. Do not damage concrete pavement to remain in place.
3. Dispose of removed concrete pavement under Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way."
4. Clean the repair area's exposed surfaces with high pressure abrasive water blasting. Further clean and dry the exposed surfaces with compressed air free of moisture and oil.
5. Apply epoxy as specified for epoxy resin adhesive for bonding new concrete to old concrete under Section 95, "Epoxy." Apply the epoxy with a stiff bristle brush.
6. Apply a portland cement concrete or mortar patch immediately following the epoxy application. Install an insert to prevent bonding of the sides of planned joints.

Repair spalls if they are:

1. Deeper than 0.05 foot
2. Wider than 0.04 foot
3. Longer than 0.3 foot

##### **40-3.17C Route and Seal Working Cracks**

Treat working cracks within 0.5 foot of either side of a planned contraction joint in compliance with the following:

1. Route and seal the crack with epoxy resin in compliance with the following:
  - 1.1. Use a powered rotary router mounted on wheels, with a vertical shaft and a routing spindle that casters as it moves along the crack
  - 1.2. Form a reservoir 3/4 inch deep by 3/8 inch wide in the crack
  - 1.3. Use equipment that does not cause raveling or spalling
  - 1.4. Place liquid sealant
2. Treat the contraction joint adjacent to the working crack in compliance with the following:
  - 2.1. Use epoxy resin under ASTM C 881/C 881M, Type IV, Grade 2 for Type B joints and secondary saw cuts for Type A1 and Type A2 joints
  - 2.2. Pressure inject epoxy resin under ASTM C 881/C881M, Type IV, Grade 1 for narrow saw cuts including initial saw cuts for Type A1 and Type A2 joints

If a working crack intersects a contraction joint, route and seal the working crack and seal the contraction joint as specified for installing liquid sealant under Section 40-3.09, "Joint Seal and Joint Sealant Installation."

##### **40-3.17D Removal and Replacement of Slabs**

As specified, remove and replace slabs or partial slabs for:

1. Insufficient thickness
2. Dowel bar misalignment
3. Working cracks more than 0.5 foot from a planned contraction joint

#### **40-4 MEASUREMENT AND PAYMENT**

##### **40-4.01 MEASUREMENT**

The contract item for concrete pavement as designated in the Verified Bid Item List is measured by the cubic yard. The Engineer calculates the pay quantity volume based on the plan dimensions. The Engineer does not measure concrete pavement placed outside those dimensions unless it was ordered by the Engineer.

The contract items for sealing joints as designated in the Verified Bid Item List are measured by the linear foot. Sealing joints are measured from field measurements for each type of sealed joint.

The contract item for shoulder rumble strips is measured by the station along each shoulder on which the rumble strips are constructed without deductions for gaps between indentations.

##### **40-4.02 PAYMENT**

The contract price paid per cubic yard for concrete pavement as designated in the Verified Bid Item List includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the concrete pavement, complete in place including bar reinforcement, tie bars, dowel bars, anchors, and fasteners, as shown on the plans and as specified in these specifications and the special provisions, and as directed by the Engineer.

The Engineer adjusts payment for each primary area deficient in average thickness in compliance with the following:

<b>Pay Adjustments for Deficient Thickness</b>	
Average Thickness Deficiency (foot)	Deficiency Adjustment (\$/yd <sup>2</sup> )
0.01	0.90
0.02	2.30
0.03	4.10
0.04	6.40
0.05	9.11

If the average thickness deficiency is less than 0.01 foot, the Engineer does not adjust payment for thickness deficiency. If the average thickness deficiency is more than 0.01 foot, the Engineer rounds to the nearest 0.01 foot and uses the adjustment table.

Full compensation for core drilling and backfilling the cores ordered by the Engineer for measuring concrete pavement thickness and determining full-depth cracks is included in the contract price paid per cubic yard for concrete pavement as designated in the Engineer's Estimate and no additional compensation will be allowed therefor. The Department does not pay for additional concrete pavement thickness measurements requested by the Contractor.

The Department does not pay for the portion of concrete that penetrates treated permeable base.

Full compensation for the quality control plan is included in the contract price paid per cubic yard for concrete pavement as designated in the Verified Bid Item List and no separate payment will be made therefor.

Full compensation for furnishing and applying asphaltic emulsion on cement treated permeable base is included in the contract price paid per cubic yard for concrete pavement as designated in the Engineer's Estimate and no separate payment will be made therefor.

Full compensation for repairing joints is included in the contract price paid per cubic yard for concrete pavement as designated in the Verified Bid Item List and no separate payment will be made therefor.

Full compensation for furnishing, calibrating, and operating profilograph equipment for Profile Index, for submitting profilograms, and for performing corrective work is included in the contract price paid per cubic yard for concrete pavement as designated in the Verified Bid Item List and no separate payment will be made therefor.

Full compensation for grooving and grinding for final finishing is included in the contract price paid per cubic yard for concrete pavement as designated in the Verified Bid Item List and no separate payment will be made therefor.

Full compensation for removing and replacing joint material for grooving and grinding is included in the contract price per cubic yard for concrete pavement as designated in the Verified Bid Item List and no separate payment will be made therefor.

Full compensation for removing and replacing slabs is included in the contract price paid per cubic yard for concrete pavement as designated in the Verified Bid Item List and no separate payment will be made therefor.









**In Section 51-1.12D replace the 4th paragraph with:**

Expanded polystyrene shall be a commercially available polystyrene board. Expanded polystyrene shall have a minimum flexural strength of 35 psi determined in conformance with the requirements in ASTM Designation: C 203 and a compressive yield strength of between 16 and 40 psi at 5 percent compression. Surfaces of expanded polystyrene against which concrete is placed shall be faced with hardboard. Hardboard shall be 1/8 inch minimum thickness, conforming to ANSI A135.4, any class. Other facing materials may be used provided they furnish equivalent protection. Boards shall be held in place by nails, waterproof adhesive, or other means approved by the Engineer.

**In Section 51-1.12F replace the 3rd paragraph with:**

Type A and AL joint seals shall consist of a groove in the concrete that is filled with field-mixed silicone sealant.

**In Section 51-1.12F in the 6th paragraph, replace the table with:**

Movement Rating (MR)	Seal Type
MR ≤ 1 inch	Type A or Type B
1 inch < MR ≤ 2 inches	Type B
2 inches < MR ≤ 4 inches	Joint Seal Assembly (Strip Seal)
MR > 4 inches	Joint Seal Assembly (Modular Unit) or Seismic Joint

**In Section 51-1.12F(3)(a) replace the 1st and 2nd paragraphs with:**

The sealant must consist of a 2-component silicone sealant that will withstand up to ±50 percent movement. Silicone sealants must be tested under California Test 435 and must comply with the following:

Specification	Requirement
Modulus at 150 percent elongation	8-75 psi
Recovery	21/32 inch max.
Notch Test	Notched or loss of bond 1/4 inch, max.
Water Resistance	Notched or loss of bond 1/4 inch, max.
Ultraviolet Exposure ASTM Designation: G 154, Table X2.1, Cycle 2.	No more than slight checking or cracking.
Cone Penetration	4.5-12.0 mm

**In Section 51-1.12F(3)(a) delete the 3rd and 8th paragraphs.**

**In Section 51-1.12F(3)(a) replace the 10th paragraph with:**

A Certificate of Compliance accompanied by a certified test report must be furnished for each batch of silicone sealant in conformance with the provisions in Section 6-1.07, "Certificates of Compliance."

**In Section 51-1.12F(3)(b) replace the 2nd paragraph with:**

The preformed elastomeric joint seal must conform to the requirements in ASTM D 2628 and the following:

1. The seal must consist of a multichannel, nonporous, homogeneous material furnished in a finished extruded form.
2. The minimum depth of the seal measured at the contact surface must be at least 95 percent of the minimum uncompressed width of the seal as designated by the manufacturer.
3. When tested in conformance with the requirements in California Test 673 for Type B seals, joint seals must provide a movement rating (MR) of not less than that shown on the plans.
4. The top and bottom edges of the joint seal must maintain continuous contact with the sides of the groove over the entire range of joint movement.
5. The seal must be furnished full length for each joint with no more than 1 shop splice in any 60-foot length of seal.

6. The Contractor must demonstrate the adequacy of the procedures to be used in the work before installing seals in the joints.
7. One field splice per joint may be made at locations and by methods approved by the Engineer. The seals are to be manufactured full length for the intended joint, then cut at the approved splice section and rematched before splicing. The Contractor must submit splicing details prepared by the joint seal manufacturer for approval before beginning splicing work.
8. Shop splices and field splices must have no visible offset of exterior surfaces and must show no evidence of bond failure.
9. At all open ends of the seal that would admit water or debris, each cell must be filled to a depth of 3 inches with commercial quality open cell polyurethane foam or closed by other means subject to approval by the Engineer.

**In Section 51-1.12F(3)(b) replace the 7th paragraph with:**

The joint seal must be installed full length for each joint with equipment that does not twist or distort the seal, elongate the seal longitudinally, or otherwise cause damage to the seal or to the concrete forming the groove.

**In Section 51-1.12F(3)(b) in the 11th paragraph, replace the 1st sentence with:**

Samples of the prefabricated joint seals, not less than 3 feet in length, will be taken by the Engineer from each lot of material.

**In Section 51-1.12H(1) in the 6th paragraph, replace the 4th and 5th sentences with:**

Each ply of fabric shall have a breaking strength of not less than 800 pounds per inch of width in each thread direction when 3" x 36" samples are tested on split drum grips. The bond between double plies shall have a minimum peel strength of 20 pounds per inch.

**In Section 51-1.12H(1) in the 8th paragraph in the table, replace the hardness (Type A) requirements with:**

Hardness (Type A)	D 2240 with 2kg mass.	55 ±5
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**In Section 51-1.12H(2) in the 1st paragraph in item A, replace the 1st and 2nd sentences with:**

The bearings shall consist of alternating steel laminates and internal elastomer laminates with top and bottom elastomer covers. Steel laminates shall have a nominal thickness of 0.075 inch (14 gage).

**In Section 51-1.13 replace the 2nd, 3rd, and 4th paragraphs with:**

Surfaces of fresh concrete at horizontal construction joints shall be thoroughly consolidated without completely removing surface irregularities. Additionally, surfaces of fresh concrete at horizontal construction joints between girder stems and decks shall be roughened to at least a 1/4-inch amplitude.

Construction joint surfaces shall be cleaned of surface laitance, curing compound, and other foreign materials using abrasive blast methods before fresh concrete is placed against the joint surface.

Construction joint surfaces shall be flushed with water and allowed to dry to a surface dry condition immediately before placing concrete.

**In Section 51-1.135 replace the 1st paragraph with:**

Mortar shall be composed of cementitious material, sand, and water proportioned and mixed as specified in this Section 51-1.135.

**In Section 51-1.135 replace the 3rd paragraph with:**

The proportion of cementitious material to sand, measured by volume, shall be 1 to 2 unless otherwise specified.

**In Section 51-1.17 in 4th paragraph, replace the 3rd sentence with:**

The surfaces shall have a profile trace showing no high points in excess of 0.25 inch, and the portions of the surfaces within the traveled way shall have a profile count of 5 or less in any 100 foot section.

**Add:**

**51-1.17A Deck Crack Treatment**

The Contractor shall use all means necessary to minimize the development of shrinkage cracks.

The Contractor shall remove all equipment and materials from the deck and clean the surface as necessary for the Engineer to measure the surface crack intensity. Surface crack intensity will be determined by the Engineer after completion of concrete cure, before prestressing, and before the release of falsework. In any 500 square foot portion of deck within the limits of the new concrete deck, should the intensity of cracking be such that there are more than 50 feet of cracks whose width at any location exceeds 0.02 inch, the deck shall be treated with a high molecular weight methacrylate (HMWM) resin system. The area of deck to be treated shall have a width that extends for the entire width of new deck inside the concrete barriers and a length that extends at least 5 feet beyond the furthest single continuous crack outside the 500 square foot portion, measured from where that crack exceeds 0.02 inch in width, as determined by the Engineer.

Deck crack treatment shall include furnishing, testing, and applying the HMWM resin system, with sand and absorbent material. If grinding is required, deck crack treatment shall take place before grinding.

**51-1.17A(1) Submittals**

Submit a HMWM resin system placement plan. When HMWM resin is to be applied within 100 feet of a residence, business, or public space including sidewalks under a structure, also submit a public safety plan. Submit plans under Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The review time is 15 days.

The HMWM resin system placement plan must include:

1. Schedule of work and testing for each bridge
2. Description of equipment for applying HMWM resin
3. Range of gel time and final cure time for HMWM resin
4. Absorbent material to be used
5. Description of equipment for applying and removing excess sand and absorbent material
6. Procedure for removing HMWM resin from the deck, including equipment
7. Storage and handling of HMWM resin components and absorbent material
8. Disposal of excess HMWM resin and containers

The public safety plan must include:

1. A public notification letter with a list of delivery and posting addresses. The letter must state HMWM resin work locations, dates, times, and what to expect. Deliver the letter to residences and businesses within 100 feet of HMWM resin work locations and to local fire and police officials at least 7 days before starting work. Post the letter at the job site.
2. An airborne emissions monitoring plan prepared and executed by a certified industrial hygienist (CIH) certified in comprehensive practice by the American Board of Industrial Hygiene. The plan must have at least 4 monitoring points including the mixing point, application point, and point of nearest public contact. Monitor airborne emissions during HMWM resin work and submit emissions monitoring results after completing the work.
3. An action plan for protection of the public when airborne emissions levels exceed permissible levels.
4. A copy of the CIH's certification.

If the measures proposed in the safety plan are inadequate to provide for public safety associated with the use of HMWM resin, the Engineer will reject the plan and direct the Contractor to revise the plan. Directions for revisions will be in writing and include detailed comments. The Engineer will notify the Contractor of the approval or rejection of a submitted or revised plan within 15 days of receipt of that plan.

**51-1.17A(2) Quality Control and Assurance**

Submit samples of HMWM resin components 15 days before use under Section 6-3, "Testing," of the Standard Specifications. Notify the Engineer 15 days before delivery of HMWM resin components in containers over 55 gallons to the job site.

Complete a test area before starting work. Results from airborne emissions monitoring of the test area must be submitted to the Engineer before starting production work.

The test area must:

1. Be approximately 500 square feet
2. Be placed within the project limits outside the traveled way at an approved location
3. Be constructed using the same equipment as the production work

4. Replicate field conditions for the production work
5. Demonstrate proposed means and methods meet the acceptance criteria
6. Demonstrate production work will be completed within the time allowed
7. Demonstrate suitability of the airborne emissions monitoring plan

The test area will be acceptable if:

1. The treated deck surface is tack free and non-oily
2. The sand cover adheres and resists brushing by hand
3. Excess sand and absorbent material has been removed
4. The coefficient of friction is at least 0.35 when tested under California Test 342

**51-1.17A(3) Materials**

HMWM resin system consists of a resin, promoter, and initiator. HMWM resin must be low odor and comply with the following:

<b>HMWM Resin</b>		
Property	Requirement	Test Method
Volatile Content *	30 percent, maximum	ASTM D 2369
Viscosity *	25 cP, maximum, (Brookfield RVT with UL adaptor, 50 RPM at 77°F)	ASTM D 2196
Specific Gravity *	0.90 minimum, at 77°F	ASTM D 1475
Flash Point *	180°F, minimum	ASTM D 3278
Vapor Pressure *	1.0 mm Hg, maximum, at 77°F	ASTM D 323
Tack-free Time	400 minutes, maximum, at 25°C	Specimens prepared per California Test 551
PCC Saturated Surface-Dry Bond Strength	3.5 MPa, minimum at 24 hours and 21 ± 1°C	California Test 551

\* Test must be performed before adding initiator.

Sand for abrasive sand finish must:

1. Be commercial quality dry blast sand
2. Have at least 95 percent pass the No. 8 sieve and at least 95 percent retained on the No. 20 sieve when tested under California Test 205

Absorbent material must be diatomaceous earth, abrasive blast dust, or substitute recommended by the HMWM resin supplier and approved by the Engineer.

**51-1.17A(4) Construction**

HMWM resin system applied by machine must be:

1. Combined in volumetric streams of promoted resin to initiated resin by static in-line mixers
2. Applied without atomization

HMWM resin system may be applied manually. Limit the quantity of resin mixed for manual application to 5 gallons at a time.

Prepare the area to be treated by abrasive blasting. Curing compound, surface contaminants, and foreign material must be removed from the bridge deck surface. Sweep the deck surface clean after abrasive blasting and blow loose material from cracks using high-pressure air.

The deck surface must be dry when abrasive blast cleaning is performed. When abrasive blast cleaning within 10 feet of public traffic, remove dust and residue from abrasive blast cleaning using a vacuum attachment operating concurrently with



**In Section 52-1.07 in the 11th paragraph, replace the table with:**

Height Zone (H) (Feet above ground)	Wind Pressure Value (psf)
$H \leq 30$	20
$30 < H \leq 50$	25
$50 < H \leq 100$	30
$H > 100$	35

**In Section 52-1.08B(1) replace the 1st paragraph with:**

Mechanical splices to be used in the work shall be selected from the Department's Pre-Qualified Products List.

**In Section 52-1.08B(1) in the 2nd paragraph, replace the table with:**

Reinforcing Bar Number	Total Slip
4	0.020-inch
5	0.020-inch
6	0.020-inch
7	0.028-inch
8	0.028-inch
9	0.028-inch
10	0.036-inch
11	0.036-inch
14	0.048-inch
18	0.060-inch

**In Section 52-1.08B(1), in the 6th paragraph, delete item C.**

**In Section 52-1.08B(2) in the 6th paragraph, replace the subparagraph with:**

The minimum preheat and interpass temperatures shall be 400° F for Grade 40 bars and 600° F for Grade 60 bars. Immediately after completing the welding, at least 6 inches of the bar on each side of the splice shall be covered by an insulated wrapping to control the rate of cooling. The insulated wrapping shall remain in place until the bar has cooled below 200° F.

**Replace Section 52-1.08B(3) with:**

**52-1.08B(3) Resistance Butt Welds**

Shop produced resistance butt welds shall be produced by a fabricator who is selected from the Department's Pre-Qualified Products List.

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall be furnished for each shipment of splice material. The Certificate of Compliance shall include heat number, lot number and mill certificates.

**In Section 52-1.08C replace the 3rd paragraph with:**

Testing on prequalification and production sample splices shall be performed at an approved independent testing laboratory. The laboratory shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors who will provide other services or materials for the project.

The independent testing laboratory shall be selected from the Department's Pre-Qualified Products List.

**In Section 52-1.08C replace the 5th paragraph with:**

Prequalification and production sample splices and testing shall conform to California Test 670 and these specifications.

**In Section 52-1.08C delete the 6th paragraph.**

**In Section 52-1.08C replace the 8th paragraph with:**

Each sample splice, as defined herein, shall be identified as representing either a prequalification or production test sample splice.

**In Section 52-1.08C in the 10th paragraph, delete the last sentence.**

**Replace Section 52-1.08C(1) with:**

**52-1.08C(1) Splice Prequalification Report**

Before using any service splices or ultimate butt splices in the work, the Contractor shall submit a Splice Prequalification Report. The report shall include the following:

- A. A copy of the manufacturer's product literature giving complete data on the splice material and installation procedures.
- B. Names of the operators who will be performing the splicing.
- C. Descriptions of the positions, locations, equipment, and procedures that will be used in the work.
- D. Certifications from the fabricator for prequalification of operators and procedures based on sample tests performed no more than 2 years before submitting the report. Each operator shall be certified by performing 2 sample splices for each bar size of each splice type that the operator will be performing in the work. For deformation-dependent types of splice devices, each operator shall be certified by performing 2 additional samples for each bar size and deformation pattern that will be used in the work.

Prequalification sample splices shall be tested by an approved independent testing laboratory and shall conform to the appropriate production test criteria and slip requirements specified herein. When epoxy-coated reinforcement is required, resistance butt welded sample splices shall have the weld flash removed by the same procedure as will be used in the work, before coating and testing. The Splice Prequalification Report shall include the certified test results for all prequalification sample splices.

The QCM shall review and approve the Splice Prequalification Report before submitting it to the Engineer for approval. The Contractor shall allow 2 weeks for the review and approval of a complete report before performing any service splicing or ultimate butt splicing in the work.

**In Section 52-1.08C(2)(a) replace the 1st, 2nd, 3rd, 4th, and 5th paragraphs with:**

Production tests shall be performed by an approved independent testing laboratory for all service splices used in the work. A production test shall consist of testing 4 sample splices prepared for each lot of completed splices. The samples shall be prepared by the Contractor using the same splice material, position, operators, location, and equipment, and following the same procedure as used in the work.

At least one week before testing, the Contractor shall notify the Engineer in writing of the date and location where the testing of the samples will be performed.

The 4 samples from each production test shall be securely bundled together and identified with a completed sample identification card before shipment to the approved independent testing laboratory. The card will be furnished by the Engineer. Bundles of samples containing fewer than 4 samples of splices shall not be tested.

Before performing any tensile tests on production test sample splices, one of the 4 samples shall be tested for, and shall conform to, the requirements for total slip in Section 52-1.08B(1), "Mechanical Splices." Should this sample not meet the total slip requirements, one retest, in which the 3 remaining samples are tested for total slip, will be allowed. Should any of the 3 remaining samples not conform to the total slip requirements, all splices in the lot represented by this production test will be rejected.

If 3 or more sample splices from a production test conform to the provisions in this Section 52-1.08C(2), "Service Splice Test Criteria," all splices in the lot represented by this production test will be considered acceptable.

**Replace Section 52-1.08C(2)(b) with:**

**52-1.08C(2)(b) Quality Assurance Test Requirements for Service Splices**

In addition to the required production tests, the Contractor shall concurrently prepare 4 service quality assurance sample splices for:

- A. The first production test performed.
- B. One of every 5 subsequent production tests, or fraction thereof, randomly selected by the Engineer.

These service quality assurance sample splices shall be prepared in the same manner as specified herein for service production sample splices.

The service quality assurance sample splices shall be shipped to the Transportation Laboratory for quality assurance testing. Each set of 4 sample splices shall be securely bundled together and identified by location and contract number with weatherproof markings before shipment. Bundles containing fewer than 4 samples of splices will not be tested. Sample splices not accompanied by the supporting documentation required in Section 52-1.08B(1), "Mechanical Splices," for mechanical splices, or in Section 52-1.08B(3), "Resistance Butt Welds," for resistance butt welds, will not be tested.

Quality assurance testing will be performed in conformance with the requirements for service production sample splices in Section 52-1.08C(2)(a), "Production Test Requirements for Service Splices."

**Replace Section 52-1.08C(3) with:**

**52-1.08C(3) Ultimate Butt Splice Test Criteria**

Ultimate production and quality assurance sample splices shall be tensile tested in conformance with the requirements described in ASTM Designation: A 370 and California Test 670.

Each sample splice shall be identified as representing a prequalification, production, or quality assurance sample splice.

The portion of hoop reinforcing bar, removed to obtain a sample splice, shall be replaced using a prequalified ultimate mechanical butt splice, or the hoop shall be replaced in kind.

Reinforcing bars, other than hoops, from which sample splices are removed, shall be repaired using ultimate mechanical butt splices conforming to the provisions in Section 52-1.08C(1), "Splice Prequalification Report," or the bars shall be replaced in kind. These bars shall be repaired or replaced such that no splices are located in any "No Splice Zone" shown on the plans.

Ultimate production and quality assurance sample splices shall rupture either: 1) in the reinforcing bar but outside of the affected zone, provided that the sample splice has visible necking or 2) anywhere, provided that the sample splice has achieved the strain requirement for necking.

When tested in conformance with the requirements in California Test 670, "Necking (Option I)," the visible necking shall be such that there is a visible decrease in the sample's cross-sectional area at the point of rupture.

When tested in conformance with the requirements in California Test 670, "Necking (Option II)," the strain requirement for necking shall be such that the largest measured strain is not less than 6 percent for No. 11 and larger bars, or not less than 9 percent for No. 10 and smaller bars.

The affected zone is the portion of the reinforcing bar where any properties of the bar, including the physical, metallurgical, or material characteristics, have been altered by fabrication or installation of the splice. The weld and one inch adjacent to the weld will be considered part of the affected zone.

**In Section 52-1.08C(3)(a) replace the 1st paragraph with:**

Production tests shall be performed for all ultimate butt splices used in the work. A production test shall consist of testing 4 sample splices removed from each lot of completed splices.

**In Section 52-1.08C(3)(a) replace the 3rd paragraph with:**

After notification has been received, the Engineer will randomly select the 4 sample splices to be removed from the lot and place tamper-proof markings or seals on them. These ultimate production sample splices shall be removed by the Contractor, and tested by an approved independent testing laboratory.

**In Section 52-1.08C(3)(a) replace the 5th, 6th, and 7th paragraphs with:**

A sample splice will be rejected if a tamper-proof marking or seal is disturbed before testing.

The 4 sample splices from each production test shall be securely bundled together and identified with a completed sample identification card before shipment to the approved independent testing laboratory. The card will be furnished by the Engineer. Bundles of samples containing fewer than 4 sample splices shall not be tested.

Before performing any tensile tests on production test sample splices, one of the 4 sample splices shall be tested for, and shall conform to, the requirements for total slip in Section 52-1.08B(1), "Mechanical Splices." Should this sample splice not meet these requirements, one retest, in which the 3 remaining sample splices are tested for total slip, will be allowed. Should any of the 3 remaining sample splices not conform to these requirements, all splices in the lot represented by this production test will be rejected.





**In Section 55-1.05 replace the 3rd paragraph with:**

Construction methods and equipment employed by the Contractor shall conform to the provisions in Section 7-1.02, "Load Limitations."

**In Section 55-2.01 replace the table in the 5th paragraph with:**

Material Conforming to ASTM Designation: A 709/A 709M	CVN Impact Value (Ft. Lbs at Temp.)
Grade 36	15 at 40° F
Grade 50* (2 inches and under in thickness)	15 at 40° F
Grade 50W* (2 inches and under in thickness)	15 at 40° F
Grade 50* (Over 2 inches to 4 inches in thickness)	20 at 40° F
Grade 50W* (Over 2 inches to 4 inches in thickness)	20 at 40° F
Grade HPS 50W* (4 inches and under in thickness)	20 at 10° F
Grade HPS 70W (4 inches and under in thickness)	25 at -10° F
Grade 100 (2 <sup>1</sup> / <sub>2</sub> inches and under in thickness)	25 at 0° F
Grade 100W (Over 2 <sup>1</sup> / <sub>2</sub> inches to 4 inches in thickness)	35 at 0° F

\* If the yield point of the material exceeds 65,000 psi, the temperature for the CVN impact value for acceptability shall be reduced 15° F for each increment of 10,000 psi above 65,000 psi

**In Section 55-2.01 replace the Structural Steel Materials table with:**

Structural Steel Materials

Material	Specification
Structural steel:	
Carbon steel	ASTM: A 709/A 709M, Grade 36 or {A 36/A 36M} <sup>a</sup>
High strength low alloy columbium vanadium steel	ASTM: A 709/A 709M, Grade 50 or {A 572/A 572M, Grade 50} <sup>a</sup>
High strength low alloy structural steel	ASTM: A 709/A 709M, Grade 50W, Grade HPS 50W, or {A 588/A 588M} <sup>a</sup>
High strength low alloy structural steel plate	ASTM: A 709/A 709M, Grade HPS 70W
High-yield strength, quenched and tempered alloy steel plate suitable for welding	ASTM: A 709/A 709M, Grade 100 and Grade 100W, or {A 514/A 514M} <sup>a</sup>
Steel fastener components for general applications:	
Bolts and studs	ASTM: A 307
Anchor bolts	ASTM: F 1554 or A 307, Grade C
High-strength bolts and studs	ASTM: A 449, Type 1
High-strength threaded rods	ASTM: A 449, Type 1
High-strength nonheaded anchor bolts	ASTM: F 1554, Grade 105, Class 2A
Nuts	ASTM: A 563, including Appendix X1 <sup>b</sup>
Washers	ASTM: F 844
Components of high-strength steel fastener assemblies for use in structural steel joints:	
Bolts	ASTM: A 325, Type 1
Tension control bolts	ASTM: F 1852, Type 1
Nuts	ASTM: A 563, including Appendix X1 <sup>b</sup>
Hardened washers	ASTM : F 436, Type 1, Circular, including S1 supplementary requirements
Direct tension indicators	ASTM: F 959, Type 325, zinc-coated
Carbon steel for forgings, pins and rollers	ASTM: A 668/A 668M, Class D
Alloy steel for forgings	ASTM: A 668/A 668M, Class G
Pin nuts	ASTM: A 36/A 36M
Carbon-steel castings	ASTM: A 27/A 27M, Grade 65-35, Class 1
Malleable iron castings	ASTM: A 47/A 47M, Grade 32510 (Grade 22010)
Gray iron castings	ASTM: A 48, Class 30B
Carbon steel structural tubing	ASTM: A 500, Grade B or A 501
Steel pipe (Hydrostatic testing will not apply)	ASTM: A 53, Type E or S, Grade B; A 106, Grade B; or A 139, Grade B
Stud connectors	AASHTO/AWS D1.5

a Grades that may be substituted for the equivalent ASTM Designation: A 709 steel, at the Contractor's option, subject to the modifications and additions specified and to the requirements of A 709.

b Zinc-coated nuts that will be tightened beyond snug or wrench tight shall be furnished with a dry lubricant conforming to Supplementary Requirement S2 in ASTM Designation: A 563.

**In Section 55-2.04 delete the 1st paragraph.**

**Delete Section 55-2.05.**

**In Section 55-3.05 replace the 1st paragraph with:**

Surfaces of bearing and base plates and other metal surfaces that are to come in contact with each other or with ground concrete surfaces shall be flat to within 1/32-inch tolerance in 12 inches and to within 1/16-inch tolerance overall. Surfaces of bearing and base plates and other metal bearing surfaces that are to come in contact with preformed fabric pads, elastomeric bearing pads, or mortar shall be flat to within 1/8-inch tolerance in 12 inches and to within 3/16-inch tolerance overall.

















Material	Specification
Steel bars, plates and shapes	ASTM Designation: A 36/A 36M or A 575, A 576 (AISI or M Grades 1016 through 1030)
Steel fastener components for general applications:	
Bolts and studs	ASTM Designation: A 307
Headed anchor bolts	ASTM Designation: A 307, Grade B, including S1 supplementary requirements
Nonheaded anchor bolts	ASTM Designation: F 1554 or A 307, Grade C, including S1 supplementary requirements and S1.6 of AASHTO Designation: M 314 supplementary requirements, or AASHTO Designation: M 314, Grade 36 or 55, including S1 supplementary requirements
High-strength bolts and studs, threaded rods, and nonheaded anchor bolts	ASTM Designation: A 449, Type 1
Nuts	ASTM Designation: A 563, including Appendix X1*
Washers	ASTM Designation: F 844
Components of high-strength steel fastener assemblies for use in structural steel joints:	
Bolts	ASTM Designation: A 325, Type 1
Tension control bolts	ASTM Designation: F 1852, Type 1
Nuts	ASTM Designation: A 563, including Appendix X1*
Hardened washers	ASTM Designation: F 436, Type 1, Circular, including S1 supplementary requirements
Direct tension indicators	ASTM Designation: F 959, Type 325, zinc-coated
Stainless steel fasteners (Alloys 304 & 316) for general applications:	
Bolts, screws, studs, threaded rods, and nonheaded anchor bolts	ASTM Designation: F 593 or F 738M
Nuts	ASTM Designation: F 594 or F 836M
Washers	ASTM Designation: A 240/A 240M and ANSI B 18.22M
Carbon-steel castings	ASTM Designation: A 27/A 27M, Grade 65-35, Class 1
Malleable iron castings	ASTM Designation: A 47, Grade 32510 or A 47M, Grade 22010
Gray iron castings Inside a roadbed Outside a roadbed	AASHTO M 306 AASHTO M306 except only AASHTO M105, Class 35B is allowed
Ductile iron castings	ASTM Designation: A 536, Grade 65-45-12
Cast iron pipe	Commercial quality
Steel pipe	Commercial quality, welded or extruded
Other parts for general applications	Commercial quality

\*Zinc-coated nuts that will be tightened beyond snug or wrench tight shall be furnished with a dyed dry lubricant conforming to Supplementary Requirement S2 in ASTM Designation: A 563.

**In Section 75-1.03 replace the 13th paragraph with:**

Concrete anchorage devices shall be mechanical expansion or resin capsule types installed in drilled holes or cast-in-place insert types. The anchorage devices shall be selected from the Department's Pre-Qualified Products List. The qualification requirements for concrete anchorage devices may be obtained from the Pre-Qualified Products List Web site.

The anchorage devices shall be a complete system, including threaded studs, hex nuts, and cut washers. Thread dimensions for externally threaded concrete anchorage devices prior to zinc coating shall conform to the requirements in ASME Standard: B1.1 having Class 2A tolerances or ASME Standard: B1.13M having Grade 6g tolerances. Thread dimensions for internally threaded concrete anchorage devices shall conform to the requirements in ASTM A 563.

**In Section 75-1.03 replace the 18th paragraph with:**

Mechanical expansion anchors shall, when installed in accordance with the manufacturer's instructions and these specifications and tested in conformance with the requirements in California Test 681, withstand the application of a sustained tension test load of at least the following values for at least 48 hours with a movement not greater than 0.035 inch:

Stud Diameter (inches)	Sustained Tension Test Load (pounds)
*3/4	5,000
5/8	4,100
1/2	3,200
3/8	2,100
1/4	1,000

\* Maximum stud diameter permitted for mechanical expansion anchors.

Resin capsule anchors shall, when installed in accordance with the manufacturer's instructions and these specifications and tested in conformance with the requirements in California Test 681, withstand the application of a sustained tension test load of at least the following values for at least 48 hours with a movement not greater than 0.010 inch:

Stud Diameter (inches)	Sustained Tension Test Load (pounds)
1-1/4	31,000
1	17,900
7/8	14,400
3/4	5,000
5/8	4,100
1/2	3,200
3/8	2,100
1/4	1,000

At least 25 days before use, the Contractor shall submit one sample of each resin capsule anchor per lot to the Transportation Laboratory for testing. A lot of resin capsule anchors is 100 units, or fraction thereof, of the same brand and product name.

**In Section 75-1.03 replace the 20th paragraph with:**

A Certificate of Compliance for concrete anchorage devices shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance."

**In Section 75-1.03 replace the 24th paragraph with:**

Sealing compound, for caulking and adhesive sealing, shall be a polysulfide or polyurethane material conforming to the requirements in ASTM Designation: C 920, Type S, Grade NS, Class 25, Use O.



**In Section 83-1.02B in the 24th paragraph in the 8th subparagraph, replace the 1st sentence with:**

Anchor cable shall be 3/4 inch preformed, 6 x 19, wire strand core or independent wire rope core (IWRC), galvanized in conformance with the requirements in Federal Specification RR-W-410, right regular lay, manufactured of improved plow steel with a minimum breaking strength of 23 tons.

**In Section 83-1.02E in the 6th paragraph, replace the 2nd sentence with:**

Cable shall be galvanized in conformance with the requirements in Federal Specification RR-W-410.

**In Section 83-1.02I replace the 5th paragraph with:**

Where shown on the plans, cables used in the frame shall be 5/16 inch in diameter, wire rope, with a minimum breaking strength of 5,000 pounds and shall be galvanized in conformance with the requirements in Federal Specification RR-W-410.

**In Section 83-1.02I replace the 14th paragraph with:**

Chain link fabric shall be 11-gage conforming to one of the following:

1. AASHTO Designation: M181, Type I, Class C
2. AASHTO Designation: M181, Type IV, Class A
3. ASTM F 1345, Class 2

**In Section 83-2.02D(1) replace the 5th paragraph with:**

When concrete barriers are to be constructed on existing structures, the dowels shall be bonded in holes drilled in the existing concrete. Drilling of holes and bonding of dowels shall conform to the following:

1. The bonding materials shall be either magnesium phosphate concrete, modified high alumina based concrete or portland cement based concrete. Magnesium phosphate concrete shall be either single component (water activated) or dual component (with a prepackaged liquid activator). Modified high alumina based concrete and portland cement based concrete shall be water activated. Bonding materials shall conform to the following requirements:

Property	Test Method	Requirements
Compressive Strength		
at 3 hours, MPa	California Test 551	21 min.
at 24 hours, MPa	California Test 551	35 min.
Flexure Strength		
at 24 hours, MPa	California Test 551	3.5 min.
Bond Strength: at 24 hours		
SSD Concrete, MPa	California Test 551	2.1 min.
Dry Concrete, MPa	California Test 551	2.8 min.
Water Absorption, %	California Test 551	10 max.
Abrasion Resistance		
at 24 hours, grams	California Test 550	25 max.
Drying Shrinkage at 4 days, %	ASTM Designation: C 596	0.13 max.
Soluble Chlorides by weight, %	California Test 422	0.05 max.
Water Soluble Sulfates by weight, %	California Test 417	0.25 max.

2. Magnesium phosphate concrete shall be formulated for minimum initial set time of 15 minutes and minimum final set time of 25 minutes at 70° F. The materials, prior to use, shall be stored in a cool, dry environment.
3. Mix water used with water activated material shall conform to the provisions in Section 90-2.03, "Water."
4. The quantity of water for single component type or liquid activator (for dual component type) to be blended with the dry component, shall be within the limits recommended by the manufacturer and shall be the least amount required to produce a pourable batter.

5. Addition of retarders, when required and approved by the Engineer, shall be in conformance with the manufacturer's recommendations.
6. Before using concrete material that has not been previously approved, a minimum of 45 pounds shall be submitted to the Engineer for testing. The Contractor shall allow 45 days for the testing. Each shipment of concrete material that has been previously approved shall be accompanied by a Certificate of Compliance as provided in Section 6-1.07, "Certificates of Compliance."
7. Magnesium phosphate concrete shall not be mixed in containers or worked with tools containing zinc, cadmium, aluminum or copper metals. Modified high alumina based concrete shall not be mixed in containers or worked with tools containing aluminum.
8. The surface of any dowel coated with zinc or cadmium shall be coated with a colored lacquer before installation of the dowel. The lacquer shall be allowed to dry thoroughly before embedment of the dowels.
9. The holes shall be drilled by methods that will not shatter or damage the concrete adjacent to the hole. The diameter of the drilled hole shall be  $\frac{1}{2}$  inch larger than the nominal diameter of the dowels.
10. The drilled holes shall be clean and dry at the time of placing the bonding material and the steel dowels. Bonding material and dowel shall completely fill the drilled hole. The surface temperature shall be 40° F or above when the bonding material is placed.
11. After bonding, dowels shall remain undisturbed for a minimum of 3 hours or until the bonding material has reached a strength sufficient to support the dowels. Dowels that are improperly bonded, as determined by the Engineer, shall be removed. The holes shall be cleaned or new holes shall be drilled and the dowels replaced and securely bonded to the concrete. Removing, redrilling and replacing improperly bonded dowels shall be performed at the Contractor's expense. Modified high alumina based concrete and portland cement based concrete shall be cured in conformance with the provisions in Section 90-7.01B, "Curing Compound Method," of the Standard Specifications. Magnesium phosphate concrete shall not be cured.

**In Section 83-2.02D(1) replace the 8th paragraph with:**

Granular material for backfill between the 2 walls of concrete barrier (Types 50E, 60F, 60GE and 60SF), as shown on the plans, shall be placed without compaction.

**In Section 83-2.02D(2) in the 1st paragraph, replace item b with:**

- b. If the 3/8-inch maximum size aggregate grading is used to construct extruded or slip-formed concrete barriers, the cementitious material content of the minor concrete shall be not less than 675 pounds per cubic yard.

**In Section 83-2.02D(2) replace the 3rd paragraph with:**

The concrete paving between the tops of the 2 walls of concrete barrier (Types 50E, 60F, 60GE, and 60SF) and the optional concrete slab at the base between the 2 walls of concrete barrier (Types 50E, 60F, 60GE, and 60SF) shall be constructed of minor concrete conforming to the provisions of Section 90-10, "Minor Concrete," except that the minor concrete shall contain not less than 505 pounds of cementitious material per cubic yard.

**In Section 83-2.02D(2) replace the 8th paragraph with:**

Granular material for backfill between the 2 walls of concrete barrier (Types 50E, 60F, 60GE and 60SF) shall be earthy material suitable for the purpose intended, having no rocks, lumps or clods exceeding 1-1/2 inches in greatest dimension.

**In Section 83-2.03 replace the 8th and 9th paragraphs with:**

Concrete barriers, except Type 50E, Type 60F, Type 60GE, and Type 60SF will be measured along the top of the barrier. Concrete barriers Type 50E, Type 60F, Type 60GE, and Type 60SF will be measured once along the centerline between the 2 walls of the barrier.

**In Section 83-2.04 replace the 3rd paragraph with:**

The contract prices paid per linear foot for concrete barrier of the type or types listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in constructing the concrete barriers, complete in place, including bar reinforcing steel, steel dowels and drilling and bonding dowels in structures, hardware for steel plate barrier, miscellaneous metal, excavation, backfill (including concrete paving for, and granular material or concrete slab used as backfill in Type 50E, Type 60F, Type 60GE, and Type 60SF concrete barrier), and disposing of surplus material and for furnishing, placing, removing and disposing of the temporary



**flasher:** Device to open and close signal circuits at a repetitive rate.

**flashing beacon control assembly:** Switches, circuit breakers, terminal blocks, flasher, wiring, and necessary electrical components all housed in a single enclosure to properly operate a beacon.

**inductive loop detector:** Detector capable of being actuated by inductance change caused by vehicle passing or standing over the loop.

**lighting standard:** Pole and mast arm supporting the luminaire.

**luminaire:** Assembly that houses the light source and controls the light emitted from the light source.

**magnetic detector:** Detector capable of being actuated by induced voltage caused by vehicle passing through the earth's magnetic field.

**powder coating:** A coating applied electrostatically using UV-stable polymer exterior grade powder.

**pre-timed controller assembly:** Operates traffic signals under a predetermined cycle length.

**signal face:** As defined in the California MUTCD.

**signal head:** As defined in the California MUTCD.

**signal indication:** As defined in the California MUTCD.

**signal section:** As defined in the California MUTCD.

**signal standard:** Pole and mast arm supporting one or more signal faces with or without a luminaire mast arm.

**traffic-actuated controller assembly:** Operates traffic signals under the varying demands of traffic as registered by detector actuation.

**traffic phase:** Signal phase as defined in the California MUTCD.

**vehicle:** As defined in the California Vehicle Code.

#### **86-1.02 REGULATIONS AND CODE**Electrical equipment must comply with one or more of the following:

1. ANSI
2. ASTM
3. 8 CA Code of Regs § 2299 et seq.
4. EIA
5. NEMA
6. NETA
7. UL

Materials and workmanship must comply with:

1. FCC
2. ITE
3. NEC
4. NRTL
5. Public Utilities Commission, General Order No. 95, "Rules for Overhead Electrical Line Construction"
6. Public Utilities Commission, General Order No. 128, "Rules for Construction of Underground Electric Supply and Communication Systems"

#### **86-1.03 COST BREAK-DOWN**

Determine quantities required to complete work. Submit the quantities as part of the cost breakdown.

The sum of the amounts for the units of work listed in the cost breakdown must equal the contract lump sum price bid for the work. Include overhead and profit for each unit of work listed in the cost breakdown. If mobilization is a bid item, include bond premium, temporary construction facilities, and material plants into the mobilization bid item, otherwise, include in each unit of work listed in the cost breakdown. Do not include costs for traffic control system in the cost breakdown.

The cost breakdown may be used to determine partial payment and to calculate payment adjustments for additional costs incurred due to a change order. If a change order increases or decreases the quantities, payment adjustment may be determined under Section 4-1.03B, "Increased or Decreased Quantities."

The cost breakdown must include type, size, and installation method for:

1. Foundations
2. Standards and poles
3. Conduit
4. Pull boxes
5. Conductors and cables
6. Service equipment enclosures

7. Telephone demarcation cabinet
8. Signal heads and hardware
9. Pedestrian signal heads and hardware
10. Pedestrian push buttons
11. Loop detectors
12. Luminaires and lighting fixtures

#### **86-1.04 EQUIPMENT LIST AND DRAWINGS**

Within 15 days of contract approval, submit for review a list of equipment and materials that you propose to install. Comply with Section 5-1.02, "Plans and Working Drawings." The list must include:

1. Name of manufacturer
2. Dimension
3. Item identification number
4. List of components

The list must be supplemented by other data as required, including:

1. Schematic wiring diagrams
2. Scale drawings of cabinets showing location and spacing of shelves, terminal blocks, and equipment, including dimensioning
3. Operation manual

Submit 2 copies of the above data. The Engineer will review within 15 days.

Electrical equipment that is manufactured as detailed on the plans will not require detailed drawings and diagrams.

Furnish 3 sets of computer-generated cabinet schematic wiring diagrams.

The cabinet schematic wiring diagram must be placed in a heavy duty plastic envelope and attached to the inside of the door of each cabinet.

Prepare diagrams, plans, and drawings using graphic symbols in IEEE 315, "Graphic Symbols for Electrical and Electronic Diagrams."

#### **86-1.05 CERTIFICATE OF COMPLIANCE**

Submit a Certificate of Compliance for all electrical material and equipment to the Engineer under Section 6-1.07, "Certificates of Compliance."

#### **86-1.06 MAINTAINING EXISTING AND TEMPORARY ELECTRICAL SYSTEMS**

Keep existing electrical system or approved temporary replacement in working order during the progress of the work. Shutdown is allowed for alteration or removal of the system. Traffic signal shutdown must be limited to normal working hours. Lighting system shutdown must not interfere with the regular lighting schedule.

Notify the Engineer before performing work on the existing system.

Notify the local traffic enforcement agency before traffic signal shutdown.

If existing or temporary system must be modified, work not shown on the plans or specified in the special provisions, but required to keep the system in working order will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

The State or local agency will:

1. Continue the operation and maintenance of existing electrical facilities
2. Continue to provide electrical energy to operate existing electrical facilities
3. Repair or replace existing facilities damaged by public traffic
4. Pay for electrical energy to operate existing or new facilities undergoing the functional tests described in Section 86-2.14C, "Functional Testing"

Verify location and depth of existing detectors, conduits, pull boxes, and other electrical facilities before using tools or equipment that may damage those facilities or interfere with an electrical system.

Notify the Engineer immediately if existing facility is damaged by your activities. Repair or replace damaged facility promptly. If you fail to complete the repair or replacement, promptly, the State will repair or replace and deduct the costs.

Damaged detectors must be replaced within 24 hours at your expense. If you fail to complete the repair within 24 hours, the State will repair and deduct the repair costs.

If roadway remains open to traffic while an existing lighting system is modified:

1. Keep existing system in working order
2. Make final connection so the modified circuit is in operation by nightfall

Keep temporary electrical installations in working order until no longer required. Remove temporary installations as specified in Section 86-7, "Removing, Reinstalling or Salvaging Electrical Equipment."

These provisions do not void your responsibilities as specified in Section 7-1.12, "Indemnification and Insurance," and Section 7-1.16, "Contractor's Responsibility for the Work and Materials."

During traffic signal system shutdown, place W3-1a, "STOP AHEAD," and R1-1, "STOP," signs in each direction to direct traffic through the intersection. For 2-lane approaches, place 2 R1-1 signs.

W3-1a and R1-1 signs must comply with Section 12-3.06, "Construction Area Signs." Use a minimum size of 30 inches for the R1-1 sign.

Cover signal faces when the system is shut down overnight. Cover temporary W3-1a and R1-1 signs when the system is turned on.

### **86-1.07 SCHEDULING OF WORK**

Except service installation and service equipment enclosure, do not work above ground until all materials are on hand to complete electrical work at each location. Schedule work to allow each system to be completed and ready for operation before opening the corresponding section of the roadway to traffic.

If street lighting exists or is installed in conjunction with traffic signals, do not turn on the signals until the street lighting is energized.

Traffic signals will not be placed in operation until the roadways to be controlled are open to public traffic.

Lighting and traffic signals, including flashing operation, will not be placed in operation before starting the functional test period specified in Section 86-2.14, "Testing."

Do not pull conductors into conduit until:

1. Pull boxes are set to grade
2. Metallic conduit is bonded

In vehicular undercrossings, soffit lights must be in operation as soon as practicable after falsework has been removed from the structure. Lighting for pedestrian structures must be in operation before opening the structure to pedestrian traffic.

If the Engineer orders soffit lights or lighting for pedestrian structures to be activated before permanent power service is available, the cost of installing and removing temporary power service will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

The initial traffic signal turn-on must be made between 9:00 a.m. and 2:00 p.m. Before the initial turn-on, all equipment, including pedestrian signals, pedestrian push buttons, vehicle detectors, lighting, signs, and pavement delineation must be installed and in working order. Direct louvers, visors, and signal faces to maximize visibility.

Start functional tests on any working day except Friday or the day before a legal holiday. You must notify the Engineer 48 hours before the start of functional test.

### **86-1.08 (BLANK)**

## **86-2 MATERIALS AND INSTALLATION**

### **86-2.01 EXCAVATING AND BACKFILLING**

Dispose of surplus excavated material under Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way."

Backfill as specified in Section 19-3, "Structure Excavation and Backfill." Compact backfill in conduit trenches outside the hinge point of slopes and not under pavement to a minimum relative compaction of 90 percent. Compact backfill within hinge points and in areas where pavement is to be constructed to a minimum relative compaction of 95 percent.

Backfill trenches and restore sidewalk, pavement, and landscaping at one intersection before starting excavation at another intersection.

If excavating on a street or highway, restrict closure to 1 lane at a time.

### **86-2.02 REMOVING AND REPLACING IMPROVEMENTS**

Replace or reconstruct sidewalk, curb, gutter, concrete pavement, asphalt concrete pavement, underlying material, lawn, plant, and other facilities damaged by your activities. Replacement material must be of equal or better quality than the material replaced. Work must be in a serviceable condition.

If a part of a square or slab of concrete sidewalk, curb, gutter, or driveway is broken or damaged, the entire square or slab must be removed and reconstructed.

Cut outline of PCC sidewalk or driveway to be removed:

1. Using a power-driven saw
2. On a neat line
3. To a 0.17-foot minimum depth

### **86-2.03 FOUNDATIONS**

Except for concrete for cast-in-drilled-hole concrete pile foundation, PCC must comply with Section 90-10, "Minor Concrete."

Construct concrete foundation on firm ground.

After each post, standard, and pedestal is properly positioned, place mortar under the base plate. Finish exposed portion to present a neat appearance. Mortar must comply with Section 51-1.135, "Mortar," except mortar must have:

1. 1 part by volume of cementitious material
2. 3 parts by volume of clean sand

Reinforced cast-in-drilled-hole concrete pile foundation must comply with Section 49, "Piling," except:

1. Material resulting from drilling holes must be disposed of as specified in Section 86-2.01, "Excavating and Backfilling"
2. Concrete for cast-in-drilled-hole concrete pile will not be considered as designated by compressive strength

Form exposed portion of the foundation to present a neat appearance and true to line and grade. The top of a foundation for post and standard must be finished to curb or sidewalk grade. Forms must be rigid and securely braced in place. Conduit ends and anchor bolts must be placed at proper height and position. Anchor bolts must be installed a maximum of 1:40 from vertical and held in place by rigid top and bottom templates. Use a steel bottom template at least 1/2 inch thick that provides proper spacing and alignment of anchor bolts near the embedded bottom end. Install bottom template before placing footing concrete.

Provide new foundation and anchor bolts of the proper type and size for relocated standards.

Steel parts must be galvanized as specified in Section 75-1.05, "Galvanizing."

Provide 2 nuts and washers for the upper threaded part of each anchor bolt. Provide 3 nuts and washers for each anchor bar or stud.

Do not weld high-strength steel used for anchor bolt, anchor bar, or stud.

Before placing concrete, moisten forms and ground. Keep forms in place until the concrete sets for at least 24 hours and is strong enough to prevent damage to surface.

Except if located on a structure, construct foundation for post, standard, and pedestal monolithically.

Apply ordinary surface finish as specified in Section 51-1.18A, "Ordinary Surface Finish."

If a foundation must be extended for additional depth, the extension work will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

Do not erect post, pole, standard, pedestal, or cabinet until the foundation is set for a minimum of 7 days.

The Engineer will choose the plumbing or raking technique for posts, standards, and pedestals. Plumb or rake by adjusting the leveling nuts before tightening nuts. Do not use shims or similar devices. After final adjustments of both top nuts and leveling nuts on anchorage assemblies have been made, and each post, standard, and pedestal on structure is properly positioned, tighten nuts as follows:

1. Tighten leveling nuts and top nuts, following a crisscross pattern, until bearing surfaces of all nuts, washers, and base plates are in firm contact.
2. Use an indelible marker to mark the top nuts and base plate with lines showing relative alignment of the nut to the base plate.
3. Tighten top nuts, following a crisscross pattern, an additional 1/6th of a turn.

In unpaved areas, construct a raised PCC pad in front of each controller cabinet.

Completely remove foundations not to be reused or abandoned.

If abandoning a foundation, remove the top of foundation, anchor bolts, and conduits to a minimum depth of 0.5 foot below sidewalk surface or original ground. Backfill the resulting hole with material equivalent to the surrounding material.

### **86-2.04 STANDARDS, STEEL PEDESTALS AND POSTS**

Bolts, including anchor bolts, nuts, and washers for signal and lighting support structures must comply with Section 55-2, "Materials." Except for bearing-type connection or slip-base, high-strength bolted connection must comply with Section

55-3.14, "Bolted Connections." Welding, nondestructive testing of welds, and acceptance and repair criteria for steel member nondestructive testing must comply with American Welding Society (AWS) D1.1.

Using stainless steel rivets, attach rectangular corrosion-resistant metal identification tag on all standards and poles, except Type 1:

1. Above the hand hole, near the base of standards and poles
2. On the underside of mast arms near the arm plate

The lettering on each identification tag must be depressed or raised, 1/4 inch tall, legible, and include the following information:

1. Name of the manufacturer
2. Date of manufacture
3. Identification number
4. Contract number
5. Unique identification code that is:
  - 5.1. Assigned by the manufacturer
  - 5.2. Traceable to a particular contract and the welds on that component
  - 5.3. Readable after the support structure is coated and installed

Type 1 standard and steel pedestal for controller cabinet must be manufactured of one of the following:

1. 0.12-inch or thicker galvanized steel
2. 4-inch standard weight galvanized steel pipe as specified in ASTM A 53
3. 4-inch Type 1 conduit with the top designed for post-top slip-fitter

Ferrous metal parts of a standard that has a shaft length of 15 feet or longer must comply with the provisions in Section 55-2, "Materials," and the following:

1. Standard must be manufactured from sheet steel of weldable grade having a minimum yield strength of 40,000 psi after manufacturing.
2. Certified test report verifying compliance with minimum yield strength requirements must be submitted. Test report may be the mill test report for the as-received steel or if the as-received steel has a lower yield strength than required you must provide test data assuring that your method of cold forming will consistently increase the tensile properties of the steel to meet the specified minimum yield strength. Test data must include tensile properties of the steel after cold forming for specific heats and thicknesses.
3. If a single-ply 5/16-inch thick pole is specified, a 2-ply pole with equivalent section modulus may be substituted.
4. Standard may be manufactured of full-length sheets or shorter sections. Each section must be manufactured from 1 or 2 pieces of sheet steel. If 2 pieces are used, the longitudinal welded seams must be directly opposite from one another. If the sections are butt-welded together, the longitudinal welded seams of adjacent sections must be placed to form continuous straight seams from base to top of standard.
5. Butt-welded circumferential joints of tubular sections requiring CJP groove welds must be made using a metal sleeve backing ring inside each joint. The sleeve must be 1/8 inch nominal thickness, or thicker, and manufactured from steel having the same chemical composition as the steel in the tubular sections to be joined. If the sections to be joined have different specified minimum yield strengths, the steel in the sleeve must have the same chemical composition as the tubular section having the higher minimum yield strength. The width of the metal sleeve must be consistent with the type of nondestructive testing selected and must be a minimum width of 1 inch. At fitting time, the sleeve must be centered at the joint and in contact with the tubular section at the point of the weld.
6. Welds must be continuous.
7. Weld metal at the transverse joint must extend to the sleeve, making the sleeve an integral part of the joint.
8. During manufacturing, longitudinal seams on vertical tubular members of cantilevered support structures must be centered on and along the side of the pole that the pole plate is located. Longitudinal seams on horizontal tubular members, including signal and luminaire arms, must be within  $\pm 45$  degrees of the bottom of the arm.
9. Longitudinal seam weld in steel tubular section may be made by the electric resistance welding process.
10. Longitudinal seam weld must have 60 percent minimum penetration, except:
  - 10.1. Within 6 inches of circumferential weld, longitudinal seam weld must be CJP groove weld.

- 10.2. Longitudinal seam weld on lighting support structure having telescopic pole segment splice must be CJP groove weld on the female end for a length on each end equal to the designated slip-fit splice length plus 6 inches.
11. Exposed circumferential weld, except fillet and fatigue-resistant weld, must be ground flush with the base metal before galvanizing or painting. Ground flush is specified as -0, +0.08-inch.
12. Circumferential weld and base plate-to-pole weld may be repaired only one time.
13. Exposed edges of the plates that make up the base assembly must be finished smooth and exposed corners of the plates must be broken. Provide shafts with slip-fitter shaft caps.
14. Surface flatness requirements of ASTM A 6 apply to plates:
  - 14.1. In contact with concrete, grout, or washers and leveling nuts
  - 14.2. In high-strength bolted connections
  - 14.3. In joints, where cap screws are used to secure luminaire and signal arms
  - 14.4. Used for breakaway slip-base assemblies
15. Standard must be straight with a maximum variation of:
  - 15.1. 1 inch measured at the midpoint of a 30-foot to 35-foot standard
  - 15.2. 3/4 inch measured at the midpoint of a 17-foot to 20-foot standard
  - 15.3. 1 inch measured 15 feet above the base plate for Type 35 and Type 36 standards
16. Zinc-coated nuts used on fastener assemblies having a specified preload obtained by specifying a prescribed tension, torque value, or degree of turn must be provided with a colored lubricant, clean and dry to the touch. The lubricant color must contrast the zinc coating color on the nut so the presence of the lubricant is visually obvious. Lubricant must be insoluble in water or the fastener components must be shipped to the job site in a sealed container.
17. Do not make additional holes in structural members.
18. Standard with an outside diameter of 12 inches or less must be round. Standard with an outside diameter greater than 12 inches must be round or multisided. Multisided standard must be convex with a minimum of 12 sides and have a minimum bend radius of 4 inches.
19. Manufacture mast arm from material specified for standard.
20. Manufacture cast steel option for slip base from material of Grade 70-40, as specified in ASTM A 27/A 27M. Other comparable material may be used if approved by the Engineer. The casting tolerances must comply with the Steel Founders' Society of America's recommendations for green sand molding.
21. One casting from each lot of a maximum of 50 castings must be radiographed as specified in ASTM E 94. Casting must comply with the acceptance criteria for severity level 3 or better for the types and categories of discontinuities in ASTM E 186 and E 446. If the casting fails the inspection, 2 additional castings must be radiographed. If the 2 additional castings fail the inspection, the entire lot will be rejected.
22. Material certification, consisting of physical and chemical properties, and radiographic film of the casting must be filed at the manufacturer's office. Certification and film must be available for inspection.
23. High-strength bolts, nuts, and flat washers used to connect slip-base plate must comply with ASTM A 325 or A 325M and be galvanized as specified in Section 75-1.05, "Galvanizing."
24. Plate washers must be manufactured by saw cutting and drilling steel plate. Steel plate must comply with AISI 1018 and be galvanized as specified in Section 75-1.05, "Galvanizing." Before galvanizing, remove burrs and sharp edges and chamfer both sides of holes to allow the bolt head to make full contact with the washer without tension.
25. High-strength cap screws for attaching arms to standards must comply with ASTM A 325, A 325M, or A 449, and the mechanical requirements in ASTM A 325 or A 325M after galvanizing. Cap screws must be galvanized as specified in Section 75-1.05, "Galvanizing." Coat threads of cap screws with a colored lubricant, clean and dry to the touch. Lubricant color must contrast the zinc-coating color on the cap screw so the presence of the lubricant is visually obvious. Lubricant must be insoluble in water or the fastener components must be shipped to the job site in a sealed container.
26. Bolted connection attaching signal or luminaire arm to pole must be considered slip critical. Galvanized faying surfaces of plates on luminaire, signal arm, and pole must be roughened by hand using a wire brush before assembly and must comply with requirements for Class C surface conditions for slip-critical connections in "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts," a specification approved by the Research Council on Structural Connections (RCSC). Paint for faying surfaces must be as specified in the RCSC specification for Class B coating.

27. The Engineer will randomly take samples of fastener components from each production lot and submit to the Transportation Laboratory with test reports as specified in ASTM fastener specifications for QA testing and evaluation. The Engineer will determine sample sizes for each fastener component.

Change in mast arm configuration is allowed as long as the mounting height and stability are maintained.

Before manufacturing, details must be adjusted to ensure that cap screw heads can be turned using conventional installation tools. During manufacturing process, to avoid interference with the cap screw heads, the position of the luminaire arm on the arm plate must be properly located.

Configure mast arm as a smooth curving arm.

Push button post, pedestrian barricade, and guard post must comply with ASTM A 53.

Assemble and tighten slip base when pole is on the ground. Threads of heavy hex nuts for each slip-base bolt must be coated with additional lubricant that is clean and dry to the touch. Tighten high strength slip-base bolts to within  $\pm 10$  foot-pounds of the following:

**Slip-Base Bolt-Tightening Requirements**

Standard Type	Torque (foot-pounds)
15-SB	150
30	150
31	200
36-20A	165

Hole in shaft of existing standard, due to removal of equipment or mast arms, must be sealed by fastening a galvanized steel disk to cover the hole. Fasten using a single central galvanized steel fastener. Seal edges of disk and hole with polysulfide or polyurethane sealing compound of Type S, Grade NS, Class 25, and Use O, as specified in ASTM C 920.

If existing standard is ordered to be relocated or reused, remove large dents, straighten shafts, and replace parts that are in poor condition. You must furnish anchor bolts or bars and nuts required for relocating or reusing standard. Repair and replacement work will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

New nuts, bolts, cap screws, and washers must be provided if:

1. Standard or mast arm is relocated
2. Used standard or mast arm is State furnished

If the standard has a slip base, a new keeper plate must be provided.

### **86-2.05 CONDUIT**

Run conductors in conduit except for overhead and where conductors are run inside poles.

You may use a larger size conduit than specified as long as you use it for the entire length between outlets. Do not use reducing coupling.

New conduit must not pass through existing foundations for standards.

#### **86-2.05A Material**

Conduit and conduit fitting must be UL or NRTL listed and comply with the following:

### Conduit and Conduit Fitting Requirements

Type 1	Hot-dip galvanized rigid steel conduit and conduit couplings must comply with UL 6 and ANSI C80.1. Zinc coating testing must comply with copper sulfate test requirements in UL 6. Conduit couplings for rigid steel conduit must be electrogalvanized.
Type 2	Hot-dip galvanized rigid steel conduit must comply with requirements for Type 1 conduit and be coated with polyvinyl chloride (PVC) or polyethylene. Exterior thermoplastic coating must have a minimum thickness of 35 mils. Internal coating must have a minimum thickness of 2 mils. Coated conduit must comply with UL 6; NEMA RN 1; or NRTL PVC-001.
Type 3	Rigid nonmetallic PVC conduit must comply with UL 651. Type A extruded rigid PVC conduit and extruded rigid HDPE conduit must comply with UL 651A. Coilable, smooth-wall, continuous length HDPE conduits must comply with UL 651B. Install at underground locations only.
Type 4	Waterproof flexible metal conduit must consist of conduit with a waterproof non-metallic sunlight-resistant jacket over an inner flexible metal core. Type 4 conduit must be UL listed for use as the grounding conductor.
Type 5	Intermediate steel conduit and conduit couplings must comply with UL 1242 and ANSI C80.6. Zinc coating testing must comply with copper sulfate test requirements in UL 1242. Conduit couplings for intermediate rigid steel conduit must be electrogalvanized. Type 5 conduit must only be used if specified.

Bonding bushings to be installed on metal conduit must be insulated and either galvanized or zinc alloy type. Fittings for steel conduit and for watertight flexible metal conduit must be UL listed at UL 514B.

#### 86-2.05B Use

Install Type 1 conduit on all exposed surfaces and at the following locations:

1. In concrete structures
2. Between a structure and nearest pull box

Exposed conduit installed on painted structure must be painted the same color as the structure.

Change or extend existing conduit runs using the same material. Install pull box if an underground conduit changes from the metallic type to Type 3.

Minimum trade size of conduit must be:

1. 1-1/2 inches from electrolier to adjacent pull box
2. 1 inch from pedestrian push button post to adjacent pull box
3. 2 inches from signal standard to adjacent pull box
4. 3 inches from controller cabinet to adjacent pull box
5. 2 inches from overhead sign to adjacent pull box
6. 2 inches from service equipment enclosure to adjacent pull box
7. 1-1/2 inches if unspecified

Two conduits must be installed between controller cabinet and adjacent pull box.

#### 86-2.05C Installation

Whether shop or field cut, ream ends of conduit to remove burrs and rough edges. Make cuts square and true. Slip joints and running threads are not allowed for coupling conduit. If a standard coupling cannot be used for coupling metal type conduit, use a threaded union coupling that is UL or NRTL listed. Tighten couplings for metal conduit to maintain a good electrical connection through conduit run.

Cut Type 3 conduit with tools that will not deform the conduit. Use solvent weld for connections.

Cut Type 2 conduit with pipe cutters; do not use hacksaws. Coated conduit must be threaded with standard conduit-threading dies. Tighten conduit into couplings or fittings using strap wrenches or approved groove-joint pliers.

Protect shop-cut threads from corrosion as follows:

**Shop-Cut Thread Protection**

Steel conduit and conduit couplings	ANSI C80.1
Electrical intermediate metal conduit and conduit couplings	ANSI C80.6

Paint conduits as specified in Section 91, "Paint." Apply 2 coats of approved unthinned zinc-rich primer of organic vehicle type. Do not use aerosol cans. Paint the following parts of conduits:

1. All exposed threads
2. Field-cut threads before installing conduit couplings to steel conduit
3. Damaged surfaces on metal conduit

Do not remove shop-installed conduit couplings.

Damaged Type 2 conduit or conduit coupling must be wrapped with at least 1 layer of 2 inch wide, 20 mil minimum thickness PVC tape, as specified in ASTM D 1000, with a minimum tape overlap of 1/2 inch. Before applying the tape, conduit or fitting must be cleaned and painted with 1 coat of rubber-resin based adhesive as recommended by the tape manufacturer. You may repair damaged spots in the thermoplastic coating by painting over with a brushing type compound supplied by the conduit manufacturer instead of the tape wrap.

The ends of Types 1, 2, or 5 conduit must be threaded and capped with standard pipe caps until wiring is started. The ends of Types 3 and 4 conduit must be capped until wiring is started. If caps are removed, replace with conduit bushings. Fit insulated bonding bushings on the end of metal conduit ending in pull box or foundation. Bell or end bushings for Type 3 conduit must be non-metallic type.

Conduit bends, except factory bends, must have a radius of not less than 6 times the inside diameter of the conduit. If factory bends are not used, bend the conduit without crimping or flattening using the longest radius practicable. Bend conduits as follows:

**Conduit-Bending Requirements**

Type 1	By methods recommended by the conduit manufacturer and with equipment approved for the purpose.
Type 2	Use standard bending tool designed for use on thermoplastic coated conduit. Conduit must be free of burrs and pits.
Type 3	By methods recommended by the conduit manufacturer and with equipment approved for the purpose. Do not expose conduit to direct flame.
Type 4	--
Type 5	By methods recommended by the conduit manufacturer and with equipment approved for the purpose.

Install pull tape in conduit that is to receive future conductors. The pull tape must be a flat woven lubricated soft-fiber polyester tape with a minimum tensile strength of 1,800 pounds and have printed sequential measurement markings every 3 feet. At least 2 feet of pull tape must be doubled back into the conduit at each end.

Existing underground conduit to be incorporated into a new system must be cleaned with a mandrel or cylindrical wire brush and blown out with compressed air.

Install conduit to a depth of not less than 30 inches below finished grade, except in sidewalk and curbed paved median areas, where it must be at least 18 inches below grade. You may lay conduit on existing pavement within new curbed median.

Conduit coupling must be a minimum of 6 inches from face of foundation.

Place a minimum of 2 inches of sand bedding in the trench before installing Type 2 or Type 3 conduit. Place a minimum of 4 inches of same material over conduit before placing additional backfill material.

Obtain approval from the Engineer before disturbing pavement. If obstruction is encountered, obtain approval from Engineer to cut small holes in the pavement to locate or remove obstruction. If jacking or drilling method is used, keep jacking or drilling pit 2 feet away from edge of pavement. Pavement must not be weakened or subgrade softened from excess water use.

Conduit used for drilling or jacking must be removed; install new conduit for completed work. If a hole larger than the conduit is pre-drilled and you install conduit by hand or by method recommended by the conduit manufacturer with equipment approved for purpose, you may install Type 2 or Type 3 conduit under pavement.

If trenching in pavement method is specified, conduit installation under pavement that is not a freeway lane or freeway to freeway connector ramp, must comply with the following:

1. Use Type 3 conduit. Place conduit under pavement in a trench approximately 2 inches wider than the outside diameter of conduit, but not exceeding 6 inches in width. Trench depth must not exceed the greater of 12 inches or conduit trade size plus 10 inches, except that at pull boxes the trench may be hand dug to required depth. The top of the installed conduit must be a minimum of 9 inches below finished grade.
2. Trenching installation must be completed before placing final pavement layer.
3. Cut pavement to be removed with a rock cutting excavator. Minimize shatter outside the removal area.
4. Place conduit in bottom of trench and backfill with minor concrete as specified in Section 90-10, "Minor Concrete.". Minor concrete must contain a minimum of 590 pounds of cementitious material per cubic yard. If the trench is in asphalt concrete pavement and pavement overlay is not placed, backfill the top 0.10 foot of trench with minor HMA.
5. Before spreading HMA, apply tack coat as specified in Section 39, "Hot Mix Asphalt."
6. Backfill trenches, except for the top 0.10 foot, by the end of each day. The top 0.10 foot must be filled within 3 days after trenching.

Conduit installed beneath railroad tracks must be:

1. Type 1 or 2
2. 1-1/2-inch minimum diameter
3. Placed a minimum depth of 42 inches below bottom of the rail

If jacking or drilling method is used, construct jacking pit to a minimum of 13 feet from the centerline of track at the near side of jacking pit. Cover jacking pit with substantial planking if left overnight.

Conduit ending in standard or pedestal must not extend more than 3 inches vertically above the foundation and must be sloped toward the handhole opening. Conduit entering through the side of non-metallic pull box must end inside the box within 2 inches of the wall and 2 inches above the bottom and be sloped toward the top of box to facilitate pulling of conductors. Conduit entering through the bottom of a pull box must end 2 inches above the bottom and be located near the end walls to leave the major portion of the box clear. At outlet, conduit must enter from the direction of the run.

Underground conduit runs, including under sidewalks, that are adjacent to gasoline service stations or other underground gasoline or diesel storage, piping, or pumps and that lead to a controller cabinet, circuit breaker panel, service, or enclosure where an arc may occur during normal operations must be sealed if the conduit is within the limits specified in the NEC for Class 1, Division 1. Use Type 1 or Type 2 conduit for these runs.

Conduit for future use in structures must be threaded and capped. Conduit leading to soffit, wall, or other lights or fixtures below pull box grade must be sealed and made watertight, except where conduit ends in a No. 9 or No. 9A pull box.

Support for conduit in or on wall or bridge superstructure must comply with the following:

1. Steel hangers, steel brackets, and other fittings must comply with Section 75-1.03, "Miscellaneous Bridge Metal."
2. Construct precast concrete conduit cradles using minor concrete and commercial quality welded wire fabric. Minor concrete must comply with Section 90-10, "Minor Concrete," and contain a minimum of 590 pounds of cementitious material per cubic yard.. The cradles must be moist cured for a minimum of 3 days. Bond precast concrete cradles to structure with epoxy adhesives specified in one of the following:

- 2.1. Section 95-2.03, "Epoxy Resin Adhesive for Bonding New Concrete to Old Concrete"
- 2.2. Section 95-2.04, "Rapid Set Epoxy Adhesive for Pavement Markers"
- 2.3. Section 95-2.05, "Standard Set Epoxy Adhesive for Pavement Markers"

3. Use pipe sleeve or form opening for conduit through bridge superstructure concrete. Sleeve or opening through either prestressed member or conventionally reinforced precast member must be:

- 3.1. Transverse to the member
- 3.2. Through the web
- 3.3. Not more than 3 inches maximum gross opening in concrete

4. Where conduits pass through the abutment concrete, wrap conduit with 2 layers of asphalt-felt building paper securely taped or wired in place. Fill space around conduit that runs through bridge abutment wall with mortar as specified in Section 51-1.135, "Mortar," except the proportion of cementitious material to sand must be 1 to 3. Fill the space around conduits that run through abutments after prestressing is completed.

5. Run surface-mounted conduit straight and true, horizontal or vertical on the wall, and parallel to wall on ceiling or other similar surfaces. Support conduit at a maximum of 5-foot intervals or closer where necessary to prevent vibration or unsightly deflection. The supports must include galvanized malleable iron conduit clamps and clamp

backs secured with expansion anchorage devices as specified for concrete anchorage devices in Section 75-1.03, "Miscellaneous Bridge Metal." Threaded studs must be galvanized and be of the largest diameter that will pass through the mounting hole in conduit clamp.

6. Where pull boxes are placed in conduit runs, conduit must be fitted with threaded bushings and bonded.
7. Mark location of conduit end in structure, curb, or wall with a "Y" that is a minimum of 3 inches tall, directly above conduit.

#### **86-2.05D Expansion Fittings**

Install expansion fitting where the conduit crosses an expansion joint in structure. Each expansion fitting for metal conduit must include a copper bonding jumper having the ampacity specified in NEC.

Each expansion-deflection fitting for expansion joints of 1-1/2-inch movement rating must be watertight and include a molded neoprene sleeve, a bonding jumper, and 2 silicon bronze or zinc-plated iron hubs. Each fitting must allow a minimum of 3/4-inch expansion, contraction, and lateral deflection.

#### **86-2.06 PULL BOXES**

You may use a larger standard size pull box than that shown on the plans or specified. Pull box, cover, and extensions must be of the same material.

##### **86-2.06A Materials**

Pull box, cover, and extension for installation in ground or sidewalk area must be precast reinforced PCC or non-PCC material. Non-PCC material must:

1. Be fire resistant with a burn rate no greater than 0.3-inch per minute per 0.1 inch of thickness when tested as specified in ASTM D 635
2. Show no significant change in physical properties with exposure to weather
3. Be dense, free of voids or porosity, and gray or brown in color

Non-PCC pull box must comply with the following:

1. Top dimensions must not exceed the bottom dimensions by more than 1 inch.
2. Extension must be of the same material as the pull box and attached to pull box to maintain the minimum combined depths.
3. Cover must not fail and must not deflect more than 1/4 inch when a vertical force of 1,500 pounds is applied through a 1/2" x 3" x 6" steel plate to a non-PCC cover on a pull box. Center the steel plate on cover with its longitudinal axis coinciding with longitudinal axis of cover.

Non-PCC pull boxes must be of sufficient rigidity that when a designated concentrated force is applied perpendicularly to the midpoint of one of the long sides at the top while the opposite long side is supported by a rigid surface, it must be possible to remove the cover without the use of tools. The designated concentrated force must be 150 pounds for a No. 3-1/2 pull box and must be 100 pounds for a No. 5 or No. 6 pull box.

If a transformer or other device must be placed in a non-metallic pull box, include recesses for hanger.

Secure cover, except ceiling pull box cover, with 3/8-inch hold down bolts, cap screws, or studs, washers, and brass stainless steel or other non-corroding-metal nut. Stainless steel hardware must have an 18 percent chromium content and an 8 percent nickel content.

Galvanize ferrous metal parts as specified in Section 75-1.05, "Galvanizing."

Traffic pull box must be provided with steel cover and special concrete footing. Steel cover must have an embossed non-skid pattern.

Traffic pull box and cover must comply with ASTM C857, "Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures," for H20 loading. You must be able to place the load anywhere on box and cover for 1 minute without causing cracks or permanent deformations.

No. 3-1/2(T) and No. 5(T) traffic pull box must be reinforced with a galvanized Z bar welded frame and cover similar to that shown on the plans for No. 6(T) pull box. Frame must be anchored to box with 1/4" x 2-1/4" concrete anchors. Four concrete anchors must be included for No. 3-1/2(T) pull box; one placed in each corner. Six concrete anchors must be included for No. 5(T) and No. 6(T) pull boxes; one placed in each corner and one near the middle of each of the longer sides.

Hold down screws must be 3/8 inch hex flange cap screws of Type 316 stainless steel. Nut must be zinc plated carbon steel, vibration resistant, and have a wedge ramp at the root of the thread. Nut must be spot welded to the underside or manufactured with galvanized Z bar pull box frame.

Steel cover must be countersunk approximately 1/4 inch to accommodate bolt head. When tightened, bolt head must not exceed more than 1/8 inch above the top of cover. A 1/4 inch tapped hole and brass bonding screw must be included.

Concrete placed around and under traffic pull box must be minor concrete as specified in Section 90-10, "Minor Concrete."

**86-2.06B Cover Marking**

Marking must be clearly defined, uniform in depth, and parallel to either the long or short sides of cover.

Marking letters must be between 1 inch to 3 inch high.

Before galvanizing steel or cast iron cover, apply marking by one of the following methods:

1. Use cast iron strip at least 1/4-inch thick with letters raised a minimum of 1/16 inch. Fasten strip to cover with 1/4 inch flathead stainless steel machine bolts and nuts. Peen bolts after tightening.
2. Use sheet steel strip at least 0.027-inch thick with letters raised a minimum of 1/16 inch. Fasten strip to cover by spot welding, tack welding, or brazing, with 1/4 inch stainless steel rivets or 1/4 inch roundhead stainless steel machine bolts and nuts. Peen bolts after tightening.
3. Bead weld the letters on cover so that letters are raised a minimum of 3/32 inch.

**86-2.06C Installation and Use**

Space pull boxes no more than 200 feet apart. You may install additional pull boxes to facilitate the work.

Pull box in ground or sidewalk area must be installed as follows:

1. Embed bottom of pull box in crushed rock.
2. Place a layer of roofing paper on crushed rock.
3. Place mortar over layer of roofing paper. Mortar must be 0.50 inch to 1 inch thick and be sloped toward the drain hole.
4. Make a 1-inch drain hole in center of pull box through mortar and roofing paper.
5. Place mortar between pull box and pull box extension, and around conduits.

Reconstruct sump of existing pull box if disturbed by your operations. Remove old grout and replace with new if the sump was grouted.

After installation of traffic pull box, install steel cover and keep bolted down when your activities are not in progress at the pull box. When steel cover is placed for final time, cover and Z bar frame must be cleaned of debris and securely tightened.

**86-2.07 (BLANK)**

**86-2.08 CONDUCTORS AND CABLES**

Conductor must be copper wire that complies with ASTM B 3 and B 8.

Wire size must comply with the following:

**Wire Size Requirements**

Conductor usage	Requirement
In loop detector lead-in cable	ASTM B 286
Everywhere except in loop detector lead-in cable	American Wire Gage (AWG) <sup>a</sup>

<sup>a</sup>Except conductor diameter must not be less than 98 percent of specified AWG diameter.

Single conductor and cable, except detector lead-in cable, must have clear, distinctive, and permanent markings on the outer surface throughout its length. The markings must include the manufacturer's name or trademark, insulation type letter designation, conductor size, voltage, and temperature rating, and for cables, it must also include number of conductors.

**86-2.08A Conductor Identification**

Conductor insulation must be a solid color with a permanent stripe as specified below. The solid color must be homogeneous through the full depth of insulation. Identification stripe must be continuous throughout the length of conductor. For conductor sizes No. 2 and larger, the insulation may be black and the ends of the conductors must be taped for a minimum length of 20 inches with electrical insulating tape of the required color.

**Conductor Identification**

Circuit	Signal Phase or Function	Identification			Size
		Insulation Color <sup>i</sup>		Band Symbols <sup>f</sup>	
		Base	Stripe <sup>a</sup>		
Vehicle Signals <sup>a,b,d</sup>	2,6	Red, Yel, Brn	Blk	2,6	14
	4,8	Red, Yel, Brn	Ora	4,8	14
	1,5	Red, Yel, Brn	None	1,5	14
	3,7	Red, Yel, Brn	Pur	3,7	14
	Ramp Meter 1	Red, Yel, Brn	None	NBR	14
	Ramp Meter 2	Red, Yel, Brn	Blk	NBR	14
Pedestrian Signals <sup>d</sup>	2p,6p	Red, Brn	Blk	2p,6p	14
	4p,8p	Red, Brn	Ora	4p,8p	14
	1p,5p	Red, Brn	None	1p,5p	14
	3p,7p	Red, Brn	Pur	3p,7p	14
Pedestrian Push Buttons <sup>d</sup>	2p,6p	Blu	Blk	P-2,P-6	14
	4p,8p	Blu	Ora	P-4,P-8	14
	1p,5p	Blu	None	P-1,P-5	14
	3p,7p	Blu	Pur	P-3,P-7	14
Traffic Signal Controller Cabinet	Ungrounded Circuit Conductor	Blk	None	CON-1	6
	Grounded Circuit Conductor	Wht	None	CON-2	6
Highway Lighting Pull Box to Luminaire	Ungrounded-Line 1	Blk	None	NBR	14
	Ungrounded-Line 2	Red	None	NBR	14
	Grounded	Wht	None	NBR	14
Multiple Highway Lighting	Ungrounded-Line 1	Blk	None	ML1	10
	Ungrounded-Line 2	Red	None	ML2	10
Lighting Control	Ungrounded to PEU	Blk	None	C1	14
	Switching leg from PEU unit or SM transformer	Red	None	C2	14
Service	Ungrounded-Line 1 (Signals)	Blk	None	NBR <sup>e</sup>	6
	Ungrounded-Line 2 (Lighting)	Red <sup>h</sup>	None	NBR <sup>e</sup>	8
Sign Lighting	Ungrounded-Line 1	Blk	None	SL-1	10
	Ungrounded-Line 2	Red	None	SL-2	10
Flashing Beacons <sup>g</sup>	Ungrounded between Flasher and Beacons	Red or Yel	None	F-Loc. <sup>c</sup>	14
Grounded and Common	Pedestrian Push Buttons	Wht	Blk	NBR	14
	Signals and Multiple Lighting	Wht	None	NBR	10
	Flashing Beacons and Sign Lighting	Wht	None	NBR	12
	Lighting Control	Wht	None	C-3	14
	Multiple Service	Wht	None	NBR	14
Railroad Preemption		Blk	None	R	14
Spares		Blk	None	NBR	14

NBR = No Band Required PEU=Photoelectric unit

<sup>a</sup>On overlaps, insulation is striped for 1st phase in designation. e.g., phase (2+3) conductor is striped as for phase 2.

<sup>b</sup>Band for overlap and special phases as required.

<sup>c</sup>Flashing beacons having separate service do not require banding.

<sup>d</sup>These requirements do not apply to signal cable.

<sup>e</sup>"S" if circuit is switched on line side of service equipment by utility.

<sup>f</sup>Band conductors in each pull box and near ends of termination points. On signal light circuits, a single band may be placed around 2 or 3 ungrounded conductors comprising a phase.

<sup>g</sup>Ungrounded conductors between service switch and flasher mechanism must be black and banded.

<sup>h</sup>Black acceptable for size No. 2 and larger. Tape ends for 20 inches with indicated color.

<sup>i</sup>Color Code: Yel-Yellow, Brn-Brown, Blu-Blue, Blk-Black, Wht-White, Ora-Orange, Pur-Purple.

### 86-2.08B Multiple Circuit Conductors

Conductor for multiple circuit must be UL or NRTL listed and rated for 600 V(ac) operation. Insulation for No. 14 to No. 4 conductors must be one of the following:

1. Type TW PVC as specified in ASTM D 2219
2. Type THW PVC
3. Type USE, RHH, or RHW cross-linked polyethylene

Minimum insulation thickness must comply with the following:

Insulation Thickness		
Insulation Type	Conductor Size	Insulation Thickness (mils)
USE, RHH, or RHW	No. 14 to No. 10	39
	No. 8 to No. 2	51
THW or TW	No. 14 to No. 10	27
	No. 8	40
	No. 6 to No. 2	54

Insulation for No. 2 and larger conductor must be one of the types listed above or Type THWN.

Conductor for wiring wall and soffit luminaire must be stranded copper with insulation rated for use at temperatures up to 125 °C.

### 86-2.08C Signal Cable

Signal cable, except for the 28-conductor type, must:

1. Not be spliced
2. Be marked in each pull box with the signal standard information it is connecting to

Signal cable must comply with the following:

1. Cable jacket must be:
  - 1.1. Black polyethylene with an inner polyester binder sheath
  - 1.2. Rated for 600 V(ac) and 75 °C
2. Filler material, if used, must be polyethylene material.
3. Conductor must be solid copper with Type THWN insulation as specified in Section 86-2.08, "Conductors and Cables," and ASTM B 286. The minimum thickness of Type THWN insulation must be 12 mils for conductor sizes No. 14 to No. 12 and 16 mils for conductor size No. 10. The minimum thickness of nylon jacket must be 4 mils.

### Conductor Signal Cable Requirements

Cable Type <sup>a</sup>	Conductor Quantity and Type	Cable Jacket Thickness (mils)		Maximum Nominal Outside Diameter (inch)	Conductor Color Code	Remarks
		Average	Minimum			
3CSC	3 - No. 14	44	36	0.40	blue/black, blue/orange, white/black stripe	Use for pedestrian push buttons and spare
5CSC	5 - No. 14	44	36	0.50	red, yellow, brown, black, white	
9CSC	8 - No. 14 1 - No. 12	60	48	0.65	No. 12 - white No. 14 - red, yellow, brown, black, and red/black, yellow/black, brown/black, white/black stripe	
12CSC	11 - No. 14 1 - No. 12	60	48	0.80	No. 12 - white No. 14 - see "12CSC Color Code and Functional Connection" table	Use for vehicle signals, pedestrian signals, spares, and signal common
28CSC	27 - No. 14 1 - No. 10	80	64	0.90	No. 10 - white No. 14 - see "28CSC Color Code and Functional Connection" table	Keep signal commons in each cable separate except at the signal controller. Label each cable as "C1" or "C2" in pull box. Use "C1" for signal phases 1, 2, 3, and 4. Use "C2" for phases 5, 6, 7, and 8.

<sup>a</sup>Conductor signal cable description starts with the number of conductors, followed by "CSC". (e.g., a signal cable with 3 conductors is labeled "3CSC".)

#### 12CSC Color Code and Functional Connection

Color Code	Termination	Phase
Red	Vehicle signal red	2, 4, 6, or 8
Yellow	Vehicle signal yellow	2, 4, 6, or 8
Brown	Vehicle signal green	2, 4, 6, or 8
Red/black stripe	Vehicle signal red	1, 3, 5, or 7
Yellow/black stripe	Vehicle signal yellow	1, 3, 5, or 7
Brown/black stripe	Vehicle signal green	1, 3, 5, or 7
Black/red stripe	Spare, or use as required for red or DONT WALK	
Black/white stripe	Spare, or use as required for yellow	
Black	Spare, or use as required for green or WALK	
Red/white stripe	Ped signal DONT WALK	
Brown/white stripe	Ped signal WALK	

### 28CSC Color Code and Functional Connection

Color Code	Termination	Phase
Red/black stripe	Vehicle signal red	2 or 6
Yellow/black stripe	Vehicle signal yellow	2 or 6
Brown/black stripe	Vehicle signal green	2 or 6
Red/orange stripe	Vehicle signal red	4 or 8
Yellow/orange stripe	Vehicle signal yellow	4 or 8
Brown/orange stripe	Vehicle signal green	4 or 8
Red/silver stripe	Vehicle signal red	1 or 5
Yellow/silver stripe	Vehicle signal yellow	1 or 5
Brown/silver stripe	Vehicle signal green	1 or 5
Red/purple stripe	Vehicle signal red	3 or 7
Yellow/purple stripe	Vehicle signal yellow	3 or 7
Brown/purple stripe	Vehicle signal green	3 or 7
Red/2 black stripes	Ped signal DONT WALK	2 or 6
Brown/2 black stripes	Ped signal WALK	2 or 6
Red/2 orange stripes	Ped signal DONT WALK	4 or 8
Brown/2 orange stripes	Ped signal WALK	4 or 8
Red/2 silver stripes	Overlap A, C red	OLA, OLC
Brown/2 silver stripes	Overlap A, C green	OLA, OLC
Red/2 purple stripes	Overlap B, D red	OLB, OLD
Brown/2 purple stripes	Overlap B, D green	OLB, OLD
Blue/black stripe	Ped push button	2 or 6
Blue/orange stripe	Ped push button	4 or 8
Blue/silver stripe	Overlap A, C yellow	OLA(y), OLC(y)
Blue/purple stripe	Overlap B, D yellow	OLB(y), OLD(y)
White/black stripe	Ped push button common	
Black/red stripe	Railroad preemption	
Black	Spare	

#### 86-2.08D Signal Interconnect Cable (SIC)

Signal interconnect cable must be a 3-pair or 6-pair type with stranded tinned copper No. 20 conductors. Each conductor insulation must be 13 mils minimum nominal thickness, color-coded, polypropylene material. Conductors must be in twisted pairs. Color coding distinguishes each pair. Each pair must be wrapped with an aluminum polyester shield and must have a No. 22 or larger stranded tinned copper drain wire inside the shielded pair.

Cable jacket must be black, high density polyethylene, rated for a minimum of 300 V(ac) and 60 °C, and must have a minimum nominal wall thickness of 40 mils. Cable jacket or moisture-resistant tape directly under the outer jacket must be marked as specified in Section 86-2.08.

You must have a minimum of 6 feet of slack at each controller cabinet. Splicing is allowed only if shown on the plans.

Insulate conductor splice with heat-shrink tubing and overlap at least 0.6 inch. Cover overall cable splice with heat-shrink tubing and overlap the cable jacket at least 1-1/2 inch.

#### 86-2.09 WIRING

Run conductors in conduit, except for overhead and temporary installations and where conductors are run inside poles.

Solder by hot iron, pouring, or dipping method, connectors and terminal lugs for conductor sizes No. 8 and smaller. Do not perform open-flame soldering.

##### 86-2.09A Circuitry

Do not run traffic signal indication conductors to a terminal block on a standard unless connected to a mounted signal head.

Use only 1 conductor to connect to each terminal of a pedestrian push button.

The common for pedestrian push button circuit must be separate from traffic signal circuit grounded conductor.

##### 86-2.09B Installation

Use a UL- or NRTL-listed inert lubricant for placing conductors in conduit.

Pull conductors into conduit by hand using pull tape specified in Section 86-2.05C, "Installation." Do not use winches or other power-actuated pulling equipment.

If adding new conductors or removing existing conductors, remove all conductors, clean conduit as specified in Section 86-2.05C, "Installation," and pull all conductors in conduit as 1 unit.

If traffic signal conductors are run in lighting standard containing street lighting conductors from a different service point, you must encase the traffic signal conductors or the lighting conductors with a flexible or rigid metal conduit for a length until the 2 types of conductors are no longer in the same raceway.

If less than 10 feet above grade, enclose temporary conductors in flexible or rigid metal conduit. Leave slack for each conductor as follows:

**Conductor Slack Requirements**

Location	Slack (feet)
Signal standard	1
Lighting standard	1
Signal and lighting standard	1
Pull box	3
Splice	3
Standards with slip base	0

After conductors are installed, seal ends of conduits with an approved sealing compound.

To form a watertight seal, tape ends of spare conductors and conductors ending in pull boxes.

Conductors and cables inside fixture or cabinet must be neatly arranged and tied together by function with self-clinching nylon cable ties or enclosed in plastic tubing or raceway.

Identify conductors for signal overlap phase as specified for vehicle signals in the table titled "Conductor Identification."

Permanently identify conductors by function. Place identification on each conductor, or each group of conductors forming a signal phase, at each pull box and near the end of conductors.

Label, tag, or band conductors by mechanical methods. Identification must not move along the conductors.

**86-2.09C Connectors and Terminals**

Connectors and terminals must be UL- or NRTL-listed crimp type. Use manufacturer-recommended tool for connectors and terminals to join conductors. Comply with MIL-T-7928.

Terminate stranded conductors smaller than No. 14 in crimp style terminal lugs.

**86-2.09D Splicing and Terminations**

Splices are allowed for:

1. Grounded conductors in pull box.
2. Pedestrian push button conductors in pull box.
3. Conductors in pull box adjacent to each electrolier or luminaire.
4. Ungrounded traffic signal conductors in pull box, if traffic signals are modified.
5. Ungrounded traffic signal conductors to a terminal compartment or signal head on a standard with conductors of the same phase in the pull box adjacent to the standard.
6. Ungrounded lighting circuit conductors in pull box, if lighting circuits are modified.

**86-2.09E Splice Insulation**

Splice must function under continuous submersion in water.

Multi-conductor cable must be spliced and insulated to form a watertight joint and to prevent moisture absorption by the cable.

Low-voltage tape must be:

1. UL or NRTL listed
2. Self-fusing, oil and flame-resistant, synthetic rubber
3. PVC, pressure-sensitive adhesive of 6 mils minimum thickness

Insulating pad must be a combination of an 80-mils thick electrical grade PVC laminate and a 120-mils thick butyl splicing compound with removable liner.

Heat-shrink tubing must comply with the following:

1. Be medium or heavy wall thickness, irradiated polyolefin tubing with an adhesive mastic inner wall.

2. Before contraction, minimum wall thickness must be 40 mils.
3. Heating must be as recommended by the manufacturer. Do not perform open-flame heating.
4. When heated, the inner wall must melt and fill crevices and interstices of the covered object and the outer wall must shrink to form a waterproof insulation.
5. After contraction, each end of the heat-shrink tubing or the open end of end cap of heat-shrink tubing must overlap the conductor insulation at least 1-1/2 inches. Coat ends and seams with electrical insulation coating.
6. Comply with requirements for extruded insulated tubing at 600 V(ac) in UL Standard 468D and ANSI C119.1, and the following requirements:

**Heat-Shrink Tubing Requirements**

Shrinkage Ratio	33 percent, maximum, of supplied diameter when heated to 125 °C and allowed to cool to 25 °C
Dielectric Strength	350 kV per inch, minimum
Resistivity	25 <sup>13</sup> Ω per inch, minimum
Tensile Strength	2,000 psi, minimum
Operating Temperature	-40 °C to 90 °C (135 °C in emergency)
Water Absorption	0.5 percent, maximum

7. If 3 or more conductors are to be enclosed in 1 splice, place mastic around each conductor before placing inside tubing. Use mastic type recommended by heat-shrink tubing manufacturer.

You may use "Method B" as an alternative method for splice insulation. Use at least 2 thicknesses of electrical insulating pad. Apply pad to splice as recommended by manufacturer.

**86-2.095 FUSED SPLICE CONNECTORS**

Install a fused disconnect splice connector in each ungrounded conductor, between the line and the ballast, in the pull box adjacent to each luminaire. Connector must be accessible in the pull box.

For 240 and 480 V(ac) circuits, each connector must simultaneously disconnect both ungrounded conductors. Connector must not have exposed metal parts, except for the head of stainless steel assembly screw. Recess head of stainless steel assembly screw a minimum of 1/32 inch below top of plastic boss that surrounds the head.

Splice connector must protect fuse from water or weather damage. Contact between fuse and fuseholder must be spring loaded. Splice connector terminals must be:

1. Rigidly crimped, using a tool recommended by manufacturer of fused splice connector, onto ungrounded conductors
2. Insulated
3. Watertight

Fuses must be standard midget ferrule type, with "Non-Time-Delay" feature, and 13/32" x 1-1/2".

**86-2.10 BONDING AND GROUNDING**

Secure all metallic components, mechanically and electrically, to form a continuous system that is effectively grounded.

Bonding jumper must be copper wire or copper braid of the same cross sectional area as a No. 8 or larger to match the load. Equipment grounding conductors must be color coded as specified in NEC or be bare.

Attach bonding jumper to standard as follows:

**Bonding Jumper Attachment**

Standard type	Requirements
Standard with handhole and traffic pull box lid cover	Use UL-listed lug and 3/16-inch diameter or larger brass or bronze bolt. Run jumper to conduit or bonding wire in adjacent pull box. Grounding jumper must be visible after the standard is installed and mortar pad is placed on foundation.
Standard without handhole	Use UL-listed ground clamp on each anchor bolt.
Slip-base standard	Use UL-listed ground clamp on each anchor bolt or attach UL-listed lug to bottom slip-base plate with 3/16-inch diameter or larger brass or bronze bolt.

Ground one side of secondary circuit of step-down transformer.

Ground metal conduit, service equipment, and grounded conductor at service point as specified by NEC and service utility, except grounding electrode conductor must be No. 6 or larger.

Equipment bonding and grounding conductors are required in conduit. Run a No. 8 minimum bare copper wire continuously in conduit system. The bonding wire must be sized as specified in the NEC.

Ground electrode must be:

1. 1 piece
2. 10-foot minimum length of one of the following:
  - 2.1. Galvanized steel rod or pipe not less than 3/4 inch in diameter
  - 2.2. Copper clad steel rod not less than 5/8 inch in diameter
3. Installed as specified in NEC
4. Bonded to service equipment using one of the following:
  - 4.1. Ground clamp
  - 4.2. Exothermic weld
  - 4.3. No. 6 or larger copper conductor

On wood pole, metallic equipment mounted less than 8 feet above ground surface must be grounded.

Bond metallic conduit in non-metallic pull box using bonding bushing or bonding jumper.

Bond metallic conduit in metal pull box using bonding bushings and bonding jumpers connected to bonding wire running in the conduit system.

#### **86-2.11 SERVICE**

Electrical service installation and materials must comply with service utility requirements.

If service equipment is to be installed on utility-owned pole, you must furnish and install conduit, conductors, and other necessary material to complete service installation. Service utility will decide riser and equipment position.

Install service equipment early on to allow service utility to schedule its work before project completion.

Furnish each service with a circuit breaker that simultaneously disconnects all ungrounded service entrance conductors.

Circuit breakers must:

1. Be quick-break on either automatic or manual operation.
2. Have operating mechanism that is enclosed and trip-free from operating handle on overload.
3. Be trip indicating.
4. Have frame size plainly marked.
5. Have trip rating clearly marked on operating handle.
6. Have overload tripping of breakers not influenced by ambient temperature range of -18 °C to 50 °C.
7. Be internal trip type.
8. Be UL or NRTL listed and comply with UL 489 or equal.
9. Have minimum interrupting capacity of 10,000 A, rms, if used as service disconnect.

Service equipment enclosure must be a NEMA 3R enclosure with dead-front panel and a hasp with a 7/16-inch hole for a padlock. Enclosure must be field marked as specified in the NEC to warn qualified persons of potential electric arc flash hazards.

Service equipment enclosure, except Types II and III, must be galvanized or have a factory-applied rust-resistant prime coat and finish coat.

Types II and III service equipment enclosures must be manufactured from one of the following:

1. Galvanized sheet steel
2. Sheet steel plated with zinc or cadmium after manufacturing
3. Aluminum

Manufacture service equipment enclosure as specified in Section 86-3.04A, "Cabinet Construction." Overlapping exterior seams and doors must comply with requirements for NEMA 3R enclosures in the NEMA Enclosure Standards.

If an alternative design is proposed for Type II or III service equipment enclosure, submit plans and shop drawings to the Engineer for approval before manufacturing.

Except for falsework lighting and power for your activities, when you submit a written request, the Engineer will arrange:

1. With the service utility to complete service connections for permanent installations and the Department will pay all costs and fees required by the service utility. Submit request at least 15 days before service connections are required.
2. For furnishing electrical energy. Energy used before contract completion will be charged to you, except cost of energy used for public benefit as ordered by the Engineer will be paid by the Department or local authorities.

Full compensation for furnishing and installing State-owned or permanent service poles, service equipment, conduit, conductors, and pull boxes, including equipment, conduit, and conductors placed on utility-owned poles, is included in the contract item of electrical work involved and no additional compensation will be allowed therefor.

If the service point is indeterminate and is shown on the plans as "approximate location" or "service point not yet established," the labor and materials required for making the connection between the service point, when established, and the nearest pull box shown on the plans will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

#### **86-2.12 WOOD POLES**

Wood poles must comply with the following:

1. Class 5 or larger as specified in ANSI O 5.1
2. Less than 180-degree twist in grain over the full length
3. 4-inch or less sweep
4. Beveled top
5. Placed in ground at least 6 feet
6. Length must be:
  - 6.1. 25 feet for service pole
  - 6.2. 35 feet for other

After each pole is set in ground, backfill space around pole with selected earth or sand, free of rocks and other deleterious material, placed in 4-inch thick layers. Moisten each layer and thoroughly compact.

Manufacture mast arm from standard pipe, free from burrs. Each mast arm must have an insulated wire inlet and wood pole mounting brackets for mast arm and tie-rod cross arm. Manufacture tie rod from structural steel and pipe.

Mount mast arm for luminaire to provide a 34-foot mounting height for a 200 W high pressure sodium luminaire and 40-foot mounting height for 310 W high pressure sodium luminaire. Traffic signals and flashing beacons on mast arm must provide a minimum vertical clearance of 17 feet from bottom of equipment to pavement.

After manufacturing, pressure-treat pole as specified in Section 58, "Preservative Treatment of Lumber, Timber and Piling," and AWPAs Use Category System: UC4B, Commodity Specification D.

If specified, treat pole with waterborne wood preservative.

#### **86-2.13 LIGHTING AND SIGN ILLUMINATION CONTROL**

Enclosure for the circuit breaker for lighting and sign illumination control must:

1. Be NEMA 3R
2. Be galvanized, cadmium plated, or powder-coated
3. Include dead front panel and a hasp with a 7/16 inch diameter hole for padlock

#### **86-2.14 TESTING**

##### **86-2.14A Materials Testing**

Deliver material and equipment to be tested to either the Transportation Laboratory or a testing location ordered by the Engineer.

Allow 30 days for acceptance testing from the time material or equipment is delivered to test site. You must pay for all shipping, handling, and related transportation costs associated with testing. If equipment is rejected, you must allow 30 days for retesting. Retesting period starts when corrected equipment is delivered to test site. You must pay for all retesting costs. Delays resulting from submittal of non-compliant materials do not relieve you from executing the contract within the allotted time.

If equipment submitted for testing does not comply with specifications, remove the equipment within 5 business days after notification that the equipment is rejected. If equipment is not removed within that period, it may be shipped to you at your expense.

When testing is complete, you will be notified. You must pick up the equipment at the test site and deliver it to the job site.

Testing and quality control procedures for all other traffic signal controller assemblies must comply with NEMA TS Standards for Traffic Control Systems.

### **86-2.14B Field Testing**

Before starting functional testing, perform the following tests in the presence of the Engineer:

#### **86-2.14B(1) Continuity**

Test each circuit for continuity.

#### **86-2.14B(2) Ground**

Test each circuit for grounds.

#### **86-2.14B(3) Insulation Resistance**

Perform insulation resistance test at 500 V(dc) on each circuit between the circuit and a ground. Insulation resistance must be 10 MΩ minimum on all circuits, except for inductive loop detector circuits that must have an insulation resistance value at least 100 MΩ.

### **86-2.14C Functional Testing**

Test periods must comply with Section 86-1.07, "Scheduling of Work."

Acceptance of new or modified traffic signal will be made only after all traffic signal circuits have been thoroughly tested.

Perform functional test to show that each part of the system functions as specified.

Functional test for each new or modified system must include at least 5 business days of continuous, satisfactory operation. If unsatisfactory performance of the system occurs, the condition must be corrected and the system retested until the 5 business days of continuous, satisfactory operation is obtained.

Except for new or modified parts of existing lighting circuit and sign illumination system, the State or local agency will maintain the system during test period and pay the electrical energy cost. Except for electrical energy, you must pay the cost of necessary maintenance performed by the State or local agency on new circuits or on the portions of existing circuits modified under the contract.

Shutdown of electrical system caused by traffic from a power interruption or from unsatisfactory performance of State-furnished materials does not constitute discontinuity of the functional test.

### **86-2.15 GALVANIZING**

Galvanize as specified in Section 75-1.05, "Galvanizing." Cabinet material may be galvanized before manufacturing as specified in ASTM A 653/653M, Coating Designation G 90.

Steel pipe standard and pipe mast arm must be hot-dip galvanized after manufacturing and must comply with Section 75-1.05, "Galvanizing." . Remove spikes from galvanized surfaces.

A minimum of 10 inches of upper end of anchor bolts, anchor bars or studs, and nuts and washers must be galvanized as specified in Section 75-1.05, "Galvanizing."

After galvanizing, bolt threads must accept galvanized standard nuts without requiring tools or causing removal of protective coatings.

Galvanizing existing materials in an electrical installation will not be required.

### **86-2.16 PAINTING**

Paint electrical equipment and material as specified in Section 59, "Painting," and the following:

1. Use paint material specified in Section 91, "Paint."
2. Factory or shop cleaning methods for metals are acceptable if equal to the methods specified.
3. Instead of temperature and seasonal restrictions for painting as specified in Section 59, "Painting," paint may be applied to equipment and materials for electrical installations if ordered by the Engineer.
4. Ungalvanized ferrous surface to be painted must be cleaned before applying prime coat. Blast cleaning is not required.
5. If an approved prime coat is applied by manufacturer, and in good condition, the 1st primer application is not required.

6. Existing equipment to be painted in the field, including State-furnished equipment, must be washed with a stiff bristle brush using a solution of water containing 2 tablespoons of heavy duty detergent powder per gallon. After rinsing, surface must be wire-brushed with a coarse, cup-shaped, power-driven brush to remove badly bonded paint, rust, scale, corrosion, grease, or dirt. Dust or residue remaining after wire brushing must be removed before priming.
7. Do not paint galvanized metal guard post, galvanized equipment, State-furnished controller cabinet, and wood poles for traffic signal or flashing beacon.
8. New galvanized metal surface to be painted in the field must be cleaned as specified for existing equipment before applying the prime coat. Do not wire brush new galvanized surface.
9. After erection, examine exterior surface for damaged primer, clean, and spot coat with primer.
10. Paint Types II and III steel service equipment enclosures with a polymeric or an enamel coating system matching Color No. 14672, light green, of Federal Standard 595B. Coating must be commercially smooth and free of flow lines, paint washout, streaks, blisters, and other defects that would impair serviceability or detract from general appearance. Coating must comply with the following:
  - 10.1. Coating hardness - Finish must have pencil lead hardness of HB, minimum, using an Eagle Turquoise pencil.
  - 10.2. Salt spray resistance - Undercutting coating system's film must not exceed 1/8-inch average, from lines scored diagonally and deep enough to expose the base metal, after 336 hours of exposure in a salt spray cabinet complying with ASTM B 117.
  - 10.3. Adherence - Must not have coating loss when tested as specified in California Test 645. Perform testing by applying coating to 4" x 8" x 0.024" test specimens of the same material as the cabinet, using the same application method.
11. Finish interior of metal signal visor, louver, and front face of back plates with 2 applications of lusterless black exterior grade latex paint formulated for application to properly prepared metal surface. Good condition factory finish will be acceptable.
12. Finish metal signal section, signal head mounting, brackets and fittings, outside of visor, pedestrian push button housing, pedestrian signal section and visor, and back face of back plate with 2 applications of lusterless black or dark olive green exterior grade latex paint formulated for application to properly prepared metal surface. Match dark olive green color to Color Chip No. 68 filed at the Transportation Laboratory.
13. Prepare and finish conduit and conduit fitting above ground the same as adjacent standard or post.
14. Relocated, reset or modified equipment previously finished as specified in this section, except for previously-finished galvanized standard with traffic signal yellow enamel, must be given a spot finishing application on newly primed areas and 1 finishing application over the entire surface. If signal face or mounting brackets are required to be painted under this section, all signal faces and mounting brackets on the same mounting must be repainted.
15. Small rusted or repaired areas of relocated or reset galvanized equipment must be cleaned and painted as specified in Section 75-1.05, "Galvanizing," for repairing damaged galvanized surfaces.
16. Stencil equipment number neatly on the standard or adjacent structure. Obtain number from the Engineer.
17. Perform painting neatly. The Engineer reserves the right to require use of brushes if the work performed by paint spraying machine is unsatisfactory.

### **86-3 CONTROLLER ASSEMBLIES**

#### **86-3.01 CONTROLLER ASSEMBLIES**

A controller assembly houses a complete mechanism for controlling the operation of traffic signals or other systems.

Model 170 and Model 2070, specified as a Model 170/2070 controller assembly, includes a Model 170, 170E or 2070 controller unit, a wired cabinet, and all auxiliary equipment required to control the system.

#### **86-3.02 (BLANK)**

#### **86-3.03 (BLANK)**

#### **86-3.04 CONTROLLER CABINETS**

Controller cabinets for controller assemblies other than Model 170/2070 must comply with the following:

##### **86-3.04A Cabinet Construction**

Cabinet must be rainproof and the top crowned 1/2 inch or slanted toward the back to prevent standing water.

Cabinet and door must be manufactured from one of the following:

1. 0.073-inch minimum thickness cold-rolled steel with continuously-welded exterior seams
2. 0.073-inch minimum thickness stainless steel with overlapping exterior seams complying with Type 4 enclosures of the NEMA Enclosure Standards
3. 0.125-inch minimum thickness aluminum with continuously-welded exterior seams

Exterior welds must be ground smooth and edges filed to a radius of at least 0.03 inch.

Cabinet manufactured from cold-rolled steel must comply with Section 86-2.16, "Painting," and the following:

1. Cabinet manufactured from cold-rolled steel must be finished with a polymeric or an enamel coating system conforming to Color No. 14672 of Federal Standard 595B.
2. Cabinet must not have coating loss when 2 test specimens, 4" x 8", of the same material and coating as the cabinet are tested. Two 9-inch-diagonal scratches exposing bare metal will be made on a specimen. Soak specimen in demineralized water for 192 hours. Tightly affix a 1-inch wide strip of masking tape to the surface and remove with one quick motion. Specimen showing evidence of blistering, softening, or peeling of paint or coating from the base metal will be rejected. Testing must comply with California Test 645, except passing 180 Degree Bend Test is not required.
3. Metal must be prepared by the 3-step, iron phosphate conversion coating bonderizing technique.
4. Inside walls, doors, and ceiling of the housing must be the same as the outside finish.

Cabinet manufactured from stainless steel must comply with the following:

1. Use annealed or quarter-hard stainless steel that complies with ASTM A 666 for Type 304, Grades A or B.
2. Use gas tungsten arc welding (GTAW) process with bare stainless steel welding electrodes. Electrodes must comply with AWS A5.9 for ER308 chromium-nickel bare arc welding electrodes.
3. Procedures, welder, and welding operator must comply with requirements and practices recommended in AWS C5.5.
4. Ground or brush exposed, exterior surfaces of stainless steel cabinet to a 25 to 50-microinch finish using iron-free abrasives or stainless steel brushes.
5. After grinding or brushing, cabinet must not show rust discoloration when:
  - 5.1. Exposed for 48 hours in a salt spray cabinet as specified in ASTM B 117
  - 5.2. Exposed 24 hours in a tap water spray cabinet with the water temperature between 38 °C and 45 °C
6. After the test, cabinet showing rust discoloration anywhere on its surface will be rejected. Rejected cabinets may be cleaned, passivated, and resubmitted for testing.

Cabinet manufactured from aluminum sheet must comply with ASTM B 209 or B 209M for 5052-H32 aluminum sheet, and the following:

1. Use gas metal arc welding (GMAW) process with bare aluminum welding electrodes. Electrodes must comply with AWS A5.10 for ER5356 aluminum alloy bare welding electrodes.
2. Procedures, welder, and welding operator for welding must comply with requirements in AWS B3.0, "Welding Procedure and Performance Qualification," and to practices recommended in AWS C5.6.
3. Surface finish of each aluminum cabinet must comply with MIL-A-8625 for a Type II, Class I coating, except anodic coating must have a minimum thickness of 0.0007 inch and a minimum coating weight of 0.001 ounce per square inch. The anodic coating must be sealed in a 5 percent aqueous solution of nickel acetate, pH 5.0 to 6.5, for 15 minutes at 97 °C. Before applying anodic coating, clean and etch cabinets using the steps below:
  - 3.1. Clean by immersing into inhibited alkaline cleaner, Oakite 61A, Diversey 909, or equal, 6 to 8 ounces per gallon at 71 °C for 5 minutes.
  - 3.2. Rinse in cold water.
  - 3.3. Etch in solution of 1-1/2 ounce of sodium fluoride and 4 to 6 ounces of sodium hydroxide per gallon of distilled water at 60 °C to 65 °C for 5 minutes.
  - 3.4. Rinse in cold water.
  - 3.5. Immerse in 50 percent by volume nitric acid solution at room temperature for 2 minutes.
  - 3.6. Rinse in cold water.

Cabinet must have:

1. Single front door with:
  - 1.1. 44-inch maximum door width.
  - 1.2. Lock, when closed and latched, that is locked.
  - 1.3. Police panel mounted on door, equipped with a keyed lock and 2 police keys. Each police key must have a shaft at least 1-3/4 inch in length.
2. Dust-tight gasketing on all door openings, permanently bonded to the metal. Mating surface of the gasketing must be covered with silicone lubricant to prevent sticking.
3. Handle that:
  - 3.1. Allows padlocking in closed position
  - 3.2. Has a minimum length of 7 inches
  - 3.3. Has a 5/8-inch, minimum, steel shank
  - 3.4. Is manufactured of cast aluminum, or zinc-plated or cadmium-plated steel
4. Cabinet door frame with:
  - 4.1. Latching mechanism that:
    - 4.1.1. Holds tension on and forms a firm seal between door gasketing and frame.
    - 4.1.2. Is a 3-point cabinet latch with nylon rollers that have a minimum diameter of 3/4 inch and equipped with ball bearings.
    - 4.1.3. Has a center catch and a pushrod made of zinc-plated or cadmium-plated steel. Pushrod must be at least 1/4" x 3/4" and turned edgewise at outer supports. Cadmium plating must comply with MIL-QQ-416. Zinc plating must comply with MIL-QQ-325.
  - 4.2. Hinging that:
    - 4.2.1. Has 3-bolt butt hinges, each having a stainless steel fixed pin. Hinges must be stainless steel or may be aluminum for aluminum cabinet.
    - 4.2.2. Is bolted or welded to the cabinet. Hinge pins and bolts must not be accessible when door is closed.
    - 4.2.3. Has a catch to hold the door open at 90 degrees and 180 degrees,  $\pm 10$  degrees, if a door is larger than 22 inches in width or 6 square feet in area. Catch must be at least 3/8-inch diameter, stainless steel plated rod capable of holding door open at 90 degrees in a 60 mph wind at an angle perpendicular to the plane of the door.
5. Lock that:
  - 5.1. Is solid brass, 6-pin tumbler, rim type
  - 5.2. Has rectangular, spring-loaded bolts
  - 5.3. Is left hand and rigidly mounted with stainless steel machine screws approximately 2 inches apart
  - 5.4. Extends 1/8 to 3/8 inch beyond the outside surface of door
6. 2 keys that are removable in the locked and unlocked positions.

Submit alternative design details for review and approval before manufacturing cabinet.  
Use metal shelves or brackets that will support controller unit and auxiliary equipment.  
Machine screws and bolts must not protrude outside the cabinet wall.

#### **86-3.04B Cabinet Ventilation**

Each controller cabinet must have:

1. 8 screened, 1/2-inch diameter or larger, raintight vent holes, in lower side or bottom of cabinet. You may use louvered vents with a permanent metal mesh or 4-ply woven polypropylene air filter held firmly in place, instead.
2. Electric fan with ball or roller bearings and capacity of at least 100 cubic feet per minute. Fan must be thermostatically controlled and manually adjustable to turn on between 32 °C and 65 °C with a differential of not more than 6 °C between automatic turn on and turn off. Fan circuit must be fused at 125 percent of ampacity of installed fan motor.

Fan and cabinet vent holes must be positioned to direct bulk of airflow over controller unit or through ventilating holes of controller unit.

### 86-3.04C Cabinet Wiring

Conductors used in controller cabinet wiring must:

1. Be neatly arranged and laced, or enclosed in plastic tubing or raceway.
2. End with properly sized captive or spring-spade terminal or be soldered to a through-panel solder lug on the back side of the terminal block. Apply crimp-style connector with proper tool to prevent opening of handle until crimp is completed.

Controller cabinet must have an equipment grounding conductor bus that is grounded to the cabinet and connected to metal conduit system or other approved ground with a No. 8, or larger, grounding conductor.

With all cabinet equipment in place and connected, resistance between grounded conductor terminal bus and equipment grounding conductor bus must be 50 MΩ, minimum, when measured with an applied voltage of 150 V(dc).

If direct current is to be grounded, connect to equipment ground only.

Use two or more terminal blocks for field connection. Install field terminal within 22 inches from front of cabinet and orient for screwdriver operation. Terminal must be a minimum of 5 inches above foundation.

No more than 3 conductors per terminal are allowed. Two flat metal jumpers, straight or U shaped, may be placed under terminal screw. At least 2 full threads of terminal screws must be fully engaged when screw is tightened. Live parts must not extend beyond the barrier.

## 86-3.05 CABINET ACCESSORIES

### 86-3.05A Labels

Include permanently printed, engraved, or silk-screened label for equipment and removable items of equipment.

Labeling must match cabinet wiring diagram. Label for shelf-mounted equipment must be on shelf face below item. Label for wall-mounted equipment must be below item.

### 86-3.05B Convenience Receptacle

Mount convenience receptacle in a readily accessible location inside the cabinet.

Convenience receptacle must be a duplex, 3-prong, NEMA 5-15R grounding type outlet that complies with UL Standard 943.

### 86-3.05C Surge Arrestor

Surge arrestor must reduce effects of power line voltage transients and have ratings as follows:

**Surge Arrestor Requirements**

Recurrent peak voltage	184 V(ac)
Energy rating, maximum	20 J
Power dissipation, average	0.85 W
Peak current for pulses less than 7 μs	1,250 A

Standby current must be 1 mA or less for 120 V(ac), 60 Hz sinusoidal input.

### 86-3.05D Terminal Blocks

Terminal block must be rated 600 V(ac), minimum, and have nickel-, silver-, or cadmium-plated brass binder head screw terminal.

Heavy duty terminal block must be rated at 20 A and have 12 position with No. 10 x 5/16-inch nickel-plated brass binder head screws and nickel-plated brass inserts. Each position must have 2 screw-type terminals. Terminal block must be barrier type with shorting bars in each of the 12 positions, and must have integral type marking strips.

Light duty terminal block must be rated at 5 A and have 12 positions with No. 6 x 1/8 inch binder head screws. Each position must have 1 screw-type terminal.

## 86-3.06 COMPONENTS

### 86-3.06A Toggle Switches

Toggle switch must:

1. Have poles as required
2. Be rated at 200 percent of circuit current for circuits of 10 A or less and 125 percent of circuit current for circuits over 10 A

#### **86-3.06B Cartridge Fuses**

Install cartridge fuse in panel-mounted fuseholder. Fuse type and rating must be as recommended by the fuse manufacturer for protecting the load.

#### **86-3.06C Circuit Breakers**

Circuit breaker must comply with Section 86-2.11, "Service," except breaker must have a minimum interrupting capacity of 5,000 A, rms.

#### **86-3.06D Connectors**

Use connector designed to interconnect various parts of circuit together and constructed for the application involved. Design connector for positive connection of circuit and easy insertion and removal of mating contacts. Connector must be permanently keyed to prevent improper connection of circuit.

Connector, or device plugging into connector, must have positive connection to prevent a circuit from breaking due to vibration, a pull on connecting cable, or similar disruptive force.

### **86-4 TRAFFIC SIGNAL FACES AND FITTINGS**

#### **86-4.01 VEHICLE SIGNAL FACES**

Each vehicle signal face must:

1. Be adjustable and allow for 360-degree rotation about vertical axis
2. Comply with ITE publication ST-017B, "Vehicle Traffic Control Signal Heads"
3. Comply with California Test 604, except for arrow and "X" faces
4. Have 3 sections arranged vertically: red at top, yellow at center, and green at bottom
5. Be of the same manufacturer and material, if more than 1 is installed at an intersection, except for programmed visibility type
6. Be sealed with neoprene gasket at top opening
7. Be LED modules

#### **86-4.01A Signal Sections**

Each signal section must comply with the following:

1. Maximum height must be 10-1/4 inches for an 8-inch section and 14-3/4 inches for a 12-inch section.
2. Housing must:
  - 2.1. Be either die-cast or permanent mold-cast aluminum, or if specified, be structural plastic.
  - 2.2. Comply with ITE publication ST-017B if die-cast or permanent mold-cast aluminum is used.
  - 2.3. Have a 1-piece, hinged, square-shaped door designed to allow access for relamping without the use of tools. Door must be secured to hold the door closed during loading tests. Module or lens must be watertight and mounted in the door.
3. Hinge pins, door latching devices, and other exposed hardware must be Type 304 or 305 stainless steel. Interior screws and fittings must be stainless steel, or steel with a corrosion resistant plating or coating.
4. Opening must be placed on top and bottom to receive 1-1/2-inch pipe. The 8-inch and 12-inch sections of an individual manufacturer must be capable of joining to form a signal face in any combination. This interchangeability is not required between metal and plastic sections.
5. Gaskets must be made of a material that is not affected if installed in a section with metal or plastic housing that is continuously operated for 336 hours.

Structural failure is described as follows:

### Signal Section Structural Failure

Signal Section Type	Requirements	Description of Structural Failure
Metal	California Test 666	Fracture within housing assembly or deflection of more than half the lens diameter of signal section during wind load test
Plastic	California Test 605	Fracture within housing assembly or deflection of more than 10 degrees in either the vertical or horizontal plane after wind load has been removed from front of signal face, or deflection of more than 6 degrees in either the vertical or horizontal plane after wind load has been removed from back of signal face

#### 86-4.01A(1) Metal Signal Sections

Each metal signal section must have a metal visor. Metal signal faces requiring backplates must have metal backplates.

#### 86-4.01A(2) Plastic Signal Sections

Housing must be molded in 1 piece, or fabricated from 2 or more pieces and joined into a single piece. Plastic must have ultraviolet stability, be unaffected by lamp heat, and be self-extinguishing. Housing and door must be colored throughout and be black, matching Color No. 17038, 27038, or 37038 of Federal Standard 595B.

Each face section must be joined to adjacent section by one of the following:

1. Minimum of 3 machine screws for 8-inch sections and 4 machine screws for 12-inch sections, installed through holes near front and back of housing. Each screw must be a No. 10 and have a nut, flat washer, and lock washer.
2. Two machine screws, each with a nut, flat washer, and lock washer, installed through holes near the front of the housing, and a fastening through the 1-1/2-inch pipe opening. Fastening must have 2 large flat washers to distribute the load around the pipe opening and 3 carriage bolts, each with a nut and lock washer. Minimum screw size must be No. 10. Minimum carriage bolt size must be 1/4 inch.

Supporting section of each signal face supported only at top or bottom must have reinforcement.

Reinforcement plate must be either sheet aluminum, galvanized steel, or cast aluminum. Each plate must be a minimum of 0.11-inch thick and have a hole concentric with 1-1/2-inch pipe-mounting hole in the housing. Place reinforcement plate as follows:

#### Reinforcement Plate Placement

Type of Reinforcement Plate	Placement
Sheet aluminum	Inside and outside of housing
Galvanized steel	Inside of housing
Cast aluminum	Outside of housing

Reinforcement plates placed outside of the housing must be finished to match signal housing color and be designed to allow proper serrated coupling between signal face and mounting hardware. Minimum of 3 No. 10 machine screws must be installed through holes in each plate and matching holes in the housing. Each screw must have a round or binder head, a nut, and lock washer.

If signal face is supported by a Type MAS side attachment slip-fitter inserted between 2 sections, place spacers between the 2 sections. Vertical dimension of spacers must allow proper seating of serrations between the slip-fitter and the 2 sections. In addition to the fastening through the large openings in housing, the 2 sections must join with at least 2 machine screws through holes near the front of housing and the spacers, and through matching holes in a reinforcing plate installed in housing. Machine screws must be No. 10 minimum size. Spacers must be made of same material as signal housing.

If reinforcing webs are used to connect back of housing to top, bottom, and sides, reinforcing plates are not required.

Holes for machine screws must be either cast or drilled during signal section manufacturing. Surround each hole with a 1/8-inch minimum width boss to allow contact between signal sections about axis of hole.

Each plastic signal section must have a plastic or metal visor. Plastic signal faces requiring backplates must have plastic backplates.

Serrated nylon washer must be inserted between each plastic signal section and metal mounting assembly. Each washer must be between 3/16- and 1/4-inch thick. Serrations must match those on signal section and mounting assembly.

### **86-4.01B Electrical Components**

Conductors must be connected to a terminal block mounted inside, at the back of housing. Terminal block must have enough screw type terminals or NEMA type tab connectors to end all field and module or lamp conductors independently. Permanently identify terminal with field conductors attached or color code conductors to facilitate field wiring.

### **86-4.01C Visors**

Include removable visor with each signal section. Comply with ITE publication ST-017B. Visors are classified by lens enclosure as full circle, tunnel or cap. Bottom opens for tunnel type and both, bottom and lower sides open for cap type. Visors must be tunnel type.

Visor must have a downward tilt between 3 and 7 degrees with a length of:

1. 9-1/2-inch minimum for nominal 12-inch round lenses
2. 7 inch for nominal 8-inch round lenses

Metal visor must be formed from 0.050-inch, minimum thickness, aluminum alloy sheet.

Plastic visor must be either formed from sheet plastic or assembled from one or more injection, rotational, or blow-molded plastic sections. Material must be of a black homogeneous color with lusterless finish. Sections must be joined using thermal, chemical, or ultrasonic bonding, or with aluminum rivets and washers permanently colored to match visor.

Secure each visor to its door and prevent removal or permanent deformation when wind load specified in California Test 605 for plastic visors or 666 for metal visors is applied to its side for 24 hours.

If directional louvers are used, fit louvers snugly into full-circular signal visors. Outside cylinder must be constructed of 0.030-inch nominal thickness, or thicker, sheet steel and vanes must be constructed of 0.016-inch nominal thickness, or thicker, sheet steel, or the cylinder and vanes must be constructed of 5052-H32 aluminum alloy of equal thickness.

### **86-4.02 (BLANK)**

### **86-4.03 (BLANK)**

### **86-4.04 BACKPLATES**

Background light must not be visible between backplate and signal face or between sections.

Plastic backplates must be either formed from sheet plastic or assembled from extruded, molded, or cast sections. Sections must be factory joined using one of the following:

1. Appropriate solvent cement
2. Aluminum rivets and washers painted or permanently colored to match backplate
3. No. 10 machine screws with washers, lock washers, and nuts, painted to match backplate

Backplate material must be of black homogeneous color with a lusterless finish. Secure each plastic backplate to the plastic signal face in a manner that prevents its removal or permanent deformation when the wind-load test is applied to either the front or back of signal face. Permanent deformation of any portion of backplate must not exceed 5 degrees forward or backward after wind loading is applied for 24 hours.

If plastic backplate requires field assembly, join with at least 4 No. 10 machine screws at each field-assembled joint. Each machine screw must have an integral or captive flat washer, a hexagonal head slotted for a standard screwdriver, and either a locking nut or a nut and lockwasher. Machine screws, nuts, and washers must be stainless steel or steel with a zinc or black-oxide finish.

If a metal backplate has 2 or more sections, fasten sections with rivets or aluminum bolts peened after assembly to avoid loosening.

Instead of the screws shown on the plans, you may use self-threading No. 10 steel screws to fasten plastic backplates to plastic signal face. Each screw must have an integral or captive flat washer, a hexagonal head slotted for a standard screwdriver, and is stainless steel or steel with a zinc or black-oxide finish.

### **86-4.05 PROGRAMMED VISIBILITY VEHICLE SIGNAL FACES**

Programmed visibility signal face and its installation must comply with Section 86-4.01, "Vehicle Signal Faces," Section 86-4.04, "Backplates," and Section 86-4.08, "Signal Mounting Assemblies."

Each programmed visibility signal section must:

1. Have a nominal 12-inch diameter circular or arrow indication
2. Comply with ITE publication ST-017B for color and arrow configuration

3. Have a cap visor
4. Have an adjustable connection that provides incremental tilting from 0 to 10 degrees above or below horizontal while maintaining a common vertical axis through couplers and mountings

Terminal connection must allow external adjustment about the mounting axis in 5-degree increments.

Signal must be mountable with ordinary tools and capable of servicing without tools. Preset adjustment at 4 degrees below horizontal.

Visibility of each programmed visibility signal face must be capable of adjustment or programming, within the face. When programmed, each signal face's indication must be visible only in those areas or lanes to be controlled, except that during dusk and darkness a faint glow to each side is allowed.

You must program the head as recommended by the manufacturer.

#### **86-4.06 PEDESTRIAN SIGNAL FACES**

Message symbols for pedestrian signal faces must be white "WALKING PERSON" and Portland orange "UPRAISED HAND." Comply with ITE Standards: "Pedestrian Traffic Control Signal Indications" and California MUTCD. Each symbol's height must be at least 10 inches and width must be at least 6-1/2 inches.

Luminance of "UPRAISED HAND" symbol must be 1,100 foot-lamberts, minimum, and luminance of "WALKING PERSON" symbol must be 1,550 foot-lamberts, minimum, when tested as specified in California Test 606.

Uniformity ratio of an illuminated symbol must not exceed 4 to 1 between the highest luminance area and the lowest luminance area.

Luminance difference between a nonilluminated symbol and the background around the symbol must be less than 30 percent when viewed with the visor and front screen in place and at a low sun angle.

Each housing, including front screen, must have maximum overall dimensions of 18-1/2-inch width, 19-inch height, and 11-1/2-inch depth.

All new pedestrian signal faces installed at an intersection must be the same make and type.

##### **86-4.06A Type A**

Each Type A pedestrian signal face must include a housing, 1 LED pedestrian signal combo module and a front screen.

##### **86-4.06B Front Screen**

Front screen installation for each Type A signal must comply with one of the following:

1. Install, tilting downward, at an angle of  $15 \pm 2$  degrees out from the top, an aluminum honeycomb screen with 0.2-inch cells, 3/8-inch thick, or a plastic screen of 3/8-inch squares, 1/2-inch thick with wall thickness of 1/16-inch. Completely cover message plate. Include a clear front cover of 1/8-inch minimum thickness acrylic plastic sheet or 1/16-inch minimum thickness polycarbonate plastic. Hold screen and cover firmly in place with stainless steel or aluminum clips or stainless steel metal screws.
2. Install a 1-1/2-inch deep eggcrate or Z crate type screen of 1/32-inch nominal thickness polycarbonate. Mount screening in a frame constructed of 0.040-inch minimum thickness aluminum alloy or polycarbonate. Install screen parallel to face of message plate and hold in place with stainless steel screws.

The Department will test screens in a horizontal position with its edges supported. When a 3-inch diameter, 4-pound steel ball is dropped on the screen from a height of 4 feet above, the front screen must not fracture, separate at the welds, or compress more than 1/8-inch. When pedestrian housing is used to support front screen during test, remove message plate from pedestrian signal housing, so there is no back support for the screen.

Screen and frame must be one of the following:

1. Manufactured from aluminum anodized flat black
2. Finished with lusterless black exterior grade latex paint formulated for application to properly prepared metal surfaces
3. Manufactured from flat black plastic

##### **86-4.06C Housing**

Pedestrian signal housing must comply with Section 86-4.01A, "Signal Sections."

##### **86-4.06D Finish**

Paint exterior of each housing as specified in Section 86-2.16, "Painting."

#### **86-4.06E Control**

Pedestrian signals must be controllable by solid-state switching devices specified for traffic signal controller assemblies.

#### **86-4.06F Terminal Blocks**

Include light duty terminal block, as specified in Section 86-4.01B, "Electrical Components," with each pedestrian signal face.

#### **86-4.07 (BLANK)**

#### **86-4.08 SIGNAL MOUNTING ASSEMBLIES**

Signal mounting assembly must include:

1. 1-1/2-inch standard steel pipe or galvanized conduit
2. Pipe fitting made of ductile iron, galvanized steel, aluminum alloy Type AC-84B No. 380, or bronze
3. Mast arm and post top slip-fitters, and terminal compartments made of cast bronze or hot-dip galvanized ductile iron

After installation, clean and paint exposed threads of galvanized conduit brackets and bracket areas damaged by wrench or vise jaws. Use wire brush to clean and apply 2 coats of approved unthinned zinc-rich primer, organic vehicle type, as specified in Section 91, "Paint." Do not use aerosol can.

Fit each terminal compartment with a terminal block having a minimum of 12 positions, each with 2 screw-type terminals. Each terminal must accommodate at least five No. 14 conductors. Include a cover on compartment for ready access to terminal block. Terminal compartment used to bracket mount signals must be bolted securely to pole or standard.

Horizontal dimension of mounting assembly members between vertical centerline of terminal compartment or slip-fitter, and the vertical centerline of each signal face must not exceed 11 inches, except where required for proper signal face alignment or to allow programming of programmed visibility signal faces.

Mounting assembly members must be plumb or level, symmetrically arranged, and securely assembled.

Mounting assembly must be watertight, and free of sharp edges or protrusions that might damage conductor insulation. Include positive locking serrated fittings that, if mated with similar fittings on signal faces, will prevent faces from rotating.

Orient each mounting assembly to allow maximum horizontal clearance to adjacent roadway.

Use slip-fitter for post-top mounting of signals. Fit slip-fitter over a 4-1/2-inch outside diameter pipe or tapered standard end. Include cadmium-plated steel set screws. Include an integral terminal compartment for each slip-fitter used to post-top mount signals with brackets.

Do not install signal faces at an intersection until all other signal equipment, including complete controller assembly, is in place and ready for operation. You may mount signal faces if covered or not directed toward traffic.

#### **86-4.09 FLASHING BEACONS**

Flashing beacon must include:

1. Single section traffic signal face with yellow or red LED module indications
2. Backplate
3. Tunnel visor
4. Flashing beacon control assembly

Beacon flasher unit must be independent of intersection flasher unit.

#### **86-4.09A Flashing Beacon Control Assembly**

##### **86-4.09A(1) Enclosure**

Enclosure must be:

1. NEMA 3R with a dead front panel and a hasp with a 7/16-inch hole for a padlock
2. Powder coated, hot-dip galvanized, or factory-applied rust resistant prime coat and finish coat

##### **86-4.09A(2) Circuit Breakers and Switches**

Circuit breakers must comply with Section 86-2.11, "Service."

Switch for manually operating sign lighting circuit must be a single-hole-mounting toggle type with a single pole and throw and rated at 12 A, 120 V(ac). Furnish switch with an indicating nameplate reading "Auto-Test."

**86-4.09A(3) Flasher**

Comply with Section 8, "Solid-State Flashers," of NEMA Standards publication No. TS 1.

Flasher must be a solid-state device with no contact points or moving parts.

Include 2 output circuits to allow alternate flashing of signal faces. Flasher must be able to carry a minimum of 10 A per circuit at 120 V(ac).

**86-4.09A(4) Wiring**

Conductors and wiring in the enclosure must comply with Section 86-2.09B(1), "Cabinet and Enclosure Installation."

**86-4.09A(5) Terminal Blocks**

Terminal blocks must be:

1. Rated 25 A, 600 V(ac)
2. Molded phenolic or nylon material
3. Barrier type with plated brass screw terminals and integral marking strips

**86-5 DETECTORS**

**86-5.01 VEHICLE DETECTORS**

Sensor unit and isolator must comply with TEES.

**86-5.01A Inductive Loop Detectors**

**86-5.01A(1) General**

Inductive loop detector includes a completely installed loop or group of loops, in the roadway, lead-in cable, and a sensor unit, with power supply installed in a controller cabinet.

**86-5.01A(2) (Blank)**

**86-5.01A(3) Construction Materials**

Conductor for each inductive loop detector must be continuous, unspliced, and one of the following:

**Conductor Options for Inductive Loop Detector**

Option	Specifications
Type 1 loop wire	Type RHW-USE neoprene-jacketed or Type USE cross-linked polyethylene insulated, No. 12, stranded copper wire with a 40 mils minimum thickness at any point.
Type 2 loop wire	Type THWN or Type XHHW, No. 14, stranded copper wire in a plastic tubing. Plastic tubing must be polyethylene or vinyl, rated for use at 105 °C, and resistant to oil and gasoline. Outside diameter of tubing must be 0.27 inch maximum with a wall thickness of 0.028 inch minimum.

Conductor for loop detector lead-in cable must be two No. 16, 19 x 29, stranded, tinned copper wires, comply with the calculated cross sectional area of ASTM B 286, Table 1, and be one of the following:

**Conductor Options for Loop Detector Lead-In Cable**

Option	Specifications
Type B lead-in cable	Insulated with 20 mils of high-density polyethylene. Conductors must be twisted together with at least 2 turns per foot and the twisted pair must be protected with a copper or aluminum polyester shield. A No. 20, minimum, copper drain wire must be connected to equipment ground within cabinet. Cable must have a high-density polyethylene or high-density polypropylene outer jacket with a nominal thickness of 32 mils. Include an amorphous interior moisture penetration barrier of nonhydroscopic polyethylene or polypropylene fillers.
Type C lead-in cable	Comply with International Municipal Signal Association (IMSA) Specification No. 50-2. A No. 20, minimum, copper drain wire must be connected to equipment ground within cabinet.

### 86-5.01A(4) Installation Details

Install loop conductors without splices and end in nearest pull box. Seal open end of cable jacket or tubing similar to splicing requirements to prevent water from entering. Do not make final splices between loops and lead-in cable until loop operations under actual traffic conditions is approved.

Splice all loop conductors for each direction of travel for same phase of a traffic signal system, in same pull box, to a detector lead-in cable that runs from pull box adjacent to loop detector to a sensor unit mounted in controller cabinet.

End all loop conductors in a pull box or terminal strip in the cabinet.

Identify and band conductors for inductive loop installations. Band, in pairs, by lane, in the pull box adjacent to the loops and near the end of conductors in the cabinet. Bands must comply with Section 86-2.09, "Wiring."

If HMA surfacing is to be placed, install loop conductors before placing uppermost layer of HMA. Install conductors in compacted layer of HMA immediately below the uppermost layer. Install conductors as shown on the plans, except fill slot with sealant flush to the surface.

When cutting loops:

1. Residue from slot cutting activities must not be allowed to flow across shoulders or lanes occupied by public traffic and must be removed from the pavement surface before residue flows off. Dispose of residue from slot cutting activities under Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way."
2. Surplus sealant must be removed from adjacent road surface without using solvents before setting.

Sealant for filling slots must comply with one of the following:

#### Elastomeric Sealant

Polyurethane material that will, within stated shelf life, cure only in the presence of moisture. Sealant must be suitable for use in both HMA and PCC.

The cured sealant must have the following performance characteristics:

**Performance Characteristics of Cured Sealant**

Specification	ASTM	Requirement
Hardness (indentation) at 25 °C and 50% relative humidity. (Type A, Model 1700 only)	D 2240 Rex.	65-85
Tensile Strength: Pulled at 508 mm per minute	D 412 Die C	3.45 MPa, min.
Elongation: Pulled at 508 mm per minute	D 412 Die C	400%, min.
Flex at -40 °C: 0.6-mm free film bend (180°) over 13-mm mandrel	--	No cracks
Weathering Resistance: Weatherometer 350 h, cured 7 days at 25 °C @ 50% relative humidity	D 822	Slight chalking
Salt Spray Resistance: 28 days at 38 °C with 5% NaCl, Die C & pulled at 508 mm per minute	B 117	3.45 MPa, min. tensile 400%, min. elongation
Dielectric Constant over a temperature range of -30 °C to 50 °C	D 150	Less than 25% change

#### Asphaltic Emulsion Sealant

Comply with State Specification 8040-41A-15. Use for filling slots in HMA pavement that are a maximum of 5/8 inch in width. Do not use where the slope causes the material to run from the slot. Material must not be thinned beyond manufacturer's recommendations. Place material when air temperature is at least 7 °C.

#### Hot-Melt Rubberized Asphalt Sealant

Hot-melt rubberized asphalt must be:

1. In solid form at room temperature and fluid at application temperature of 190 °C to 205 °C. Fumes must be non-toxic.
2. Suitable for use in both HMA and PCC.
3. Melted in a jacketed, double-boiler type melting unit. Temperature of heat transfer medium must not exceed 245 °C.

4. Applied with a pressure feed applicator or pour pot, when the pavement surface temperature is greater than 4 °C.
5. Packaged in containers clearly marked "Detector Loop Sealant" and specifying manufacturer's batch and lot number.

The cured sealant must have the following performance characteristics:

<b>Performance Characteristics of Cured Sealant</b>		
Specification	ASTM	Requirement
Cone Penetration, 25 °C, 150 g, 5 s	D 5329, Sec. 6	3.5 mm, max
Flow, 60 °C	D 5329, Sec. 8	5 mm, max
Resilience, 25 °C	D 5329, Sec. 12	25%, min
Softening Point	D 36	82 °C, min
Ductility, 25 °C, 50 mm/min	D 113	300 mm, min
Flash Point, COC, °C	D 92	288 °C, min
Viscosity, Brookfield Thermosel, No. 27 Spindle, 20 rpm, 190 °C	D 150	Less than 25% change

#### **86-5.01B Magnetic Detectors**

Cable from pull box, adjacent to magnetic detector sensing element, to the field terminals in the controller cabinet must be the type specified for inductive loop detectors.

#### **86-5.02 PEDESTRIAN PUSH BUTTON ASSEMBLIES**

Housing must be either die-cast or permanent mold-cast aluminum, or ultraviolet stabilized, self-extinguishing structural plastic, if specified. Plastic housing must be black matching Color No. 17038, 27038 or 37038 of Federal Standard 595B, and colored throughout. Assembly must be rainproof and shockproof in any weather condition.

Switch must be a single-pole, double-throw, switching unit, with screw type terminals, rated 15 A at 125 V(ac), and must have:

1. Plunger actuator and a U frame to allow recessed mounting in push button housing
2. Operating force of 3.5 pounds
3. 1/64-inch maximum pretravel
4. 7/32-inch minimum overtravel
5. 0.0004- to 0.002-inch differential travel
6. 2-inch minimum diameter actuator

Where pedestrian push button is attached to a pole, shape housing to fit the pole curvature and secure. Include saddles to make a neat fit if needed.

Where a pedestrian push button is mounted on top of a 2-1/2-inch diameter post, fit housing with a slip-fitter and use screws for securing rigidly to post.

Pedestrian push button signs must be porcelain enameled metal or structural plastic.

Install push button and sign on crosswalk side of pole.

Point arrows on push button signs in the same direction as the corresponding crosswalk.

Attach sign on Type B push button assembly.

For Type C pedestrian push button assembly, mount instruction sign on the same standard as the push button assembly, using 2 straps and saddle brackets. Straps and saddle brackets must be corrosion-resisting chromium nickel steel and comply with ASTM A 167, Type 302B. Theft-proof bolts must be stainless steel with a chromium content of at least 17 percent and a nickel content of at least 8 percent.

### **86-6 LIGHTING**

#### **86-6.01 HIGH PRESSURE SODIUM LUMINAIRES**

High pressure sodium luminaires must be the enclosed cutoff type.

Housing must be manufactured from aluminum. Painted or powder-coated housing must withstand a 1,000-hour salt spray test as specified in ASTM B 117.

Other metal parts must be corrosion resistant.

Each housing must include a slip-fitter that can be mounted on a 2-inch pipe tenon and can be adjusted 5 degrees from the axis of the tenon. Clamping brackets of slip-fitter must not bottom out on housing bosses when adjusted within the ±5 degree range.

The slip-fitter mounting bracket must not permanently set in excess of 0.020-inch when the 3/8-inch diameter cap screw used for mounting is tightened to 10 foot-pounds.

Luminaire to be mounted horizontally on mast arm, when tested as specified in California Test 611, must be capable of withstanding cyclic loading for a minimum of 2 million cycles without failure of any luminaire parts as follows:

**Cyclic Loading**

Plane	Internal Ballast	Minimum Peak Acceleration Level <sup>a</sup>
Vertical	Removed	3.0 G peak-to-peak sinusoidal loading (same as 1.5 G peak)
Horizontal <sup>b</sup>	Installed	1.5 G peak-to-peak sinusoidal loading (same as 0.75 G peak)
Vertical	Installed	1.0 G peak-to-peak sinusoidal loading (same as 0.5 G peak)

<sup>a</sup>G = Acceleration of gravity

<sup>b</sup>Perpendicular to direction of mast arm

If a photoelectric unit receptacle is included, a raintight shorting cap must be installed. If luminaire housing has a hole for the receptacle, hole must be permanently closed, covered, and sealed with weatherproof material.

Optical system must be in a sealed chamber and include:

1. Reflector shaped so that a minimum of light is reflected through the arc tube of the lamp. Reflector surface must be specular and protected by either an anodized finish or a silicate film on its specular surface.
2. Refractor or lens mounted in a door frame that is hinged to the housing and secured with a spring-loaded latch. Refractor must be made of glass or polycarbonate plastic. Lens must be made of heat- and impact-resistant glass.
3. Lamp socket that is a porcelain enclosed mogul-multiple type. Shell must include integral lamp grips to assure electrical contact under conditions of normal vibration. Socket must be mounted in the luminaire to allow presetting a variety of specified light distribution patterns. Socket must be rated for 1,500 W and 600 V(ac), and a 4 kV pulse.
4. Lamp.

Sealing must be provided by a gasket between the reflector and:

1. Refractor or lens
2. Lamp socket

Chamber must allow for filtered flow of air in and out of the chamber from lamp heat. Filtering must be accomplished by either a separate filter or a filtering gasket.

If components are mounted on a down-opening door, door must be hinged and secured to luminaire housing separately from refractor or flat lens frame. Door must be easily removable and replaceable, and secured to housing to prevent accidental opening when refractor or flat lens frame is opened.

Field wires connected to luminaire must terminate on a barrier-type terminal block secured to the housing. Terminal screws must be captive and equipped with wire grips for conductors up to No. 6. Each terminal positions must be clearly identified.

Minimum light distribution for each luminaire must meet the isolux diagrams.

Maximum brightness of each cutoff luminaire, with the lamp indicated, must be as follows:

**Cutoff Type**

Lamp ANSI Code No.	Lamp Wattage	Maximum Brightness foot-lamberts
S55	150	40
S66	200	40
S50	250	50
S67	310	60
S51	400	75

Brightness readings will be taken using a brightness meter with an acceptance angle of 1.5 degrees. When measured on the 90-degree and 270-degree lateral angle line, maximum brightness must not exceed above specified brightness when meter is located at a horizontal distance of 120 feet and a vertical distance of 7.5 feet between luminaire and meter, or at an angle of 3 degrees 35 minutes from the horizontal to the line between luminaire and meter. Measurements must be made from 90-degree line and 270-degree line, and averaged. Lamp used for each test must operate at wattage necessary to produce the following light output:

### Light Output

Lamp Wattage	Lumens
150	16,000
200	22,000
250	27,000
310	37,000
400	50,000

#### 86-6.01A High Pressure Sodium Lamp Ballasts

Each ballast must:

1. Operate the lamp for its rated characteristics and wattage
2. Continuously operate at ambient air temperatures from -20 °C to 25 °C without reduction in ballast life
3. Operate for at least 180 cycles of 12 hours on and 12 hours off, with the lamp circuit in an open or short-circuited condition and without measurable reduction in operating requirements
4. Have a design life of not less than 60,000 hours
5. Provide proper starting and operating waveforms, voltage, and current
6. Provide reliable lamp starting and operation at ambient temperature down to -20 °C for the rated life of lamp

Ballast must be tested as specified in ANSI C82.6-1980, "Methods of Measurement of High-Intensity-Discharge Lamp Ballasts."

Starting aids for ballast of a given lamp wattage must be interchangeable between ballasts of same wattage and manufacturer, without adjustment.

Each integral ballast must consist of separate components that can be easily replaced. An encapsulated starting aid will be counted as a single component. Each component must include screw terminals, NEMA tab connectors, or a single multi-circuit connector. Conductors and terminals must be identified.

Mount heat-generating component so as to use the portion of the luminaire it is mounted to as a heat sink. Place capacitor a maximum practicable distance from heat-generating components or thermally shield to limit the case temperature to 75 °C.

Transformer and inductor must be resin-impregnated for protection against moisture. Capacitors, except those in starting aids, must be metal cased and hermetically sealed.

The Department will test high-pressure sodium lamp ballast. High-pressure sodium lamp ballast must have a characteristic curve that will intersect both of the lamp-voltage limit lines between the wattage limit lines and remain between the wattage limit lines throughout the full range of lamp voltage. This requirement must be met at the rated input voltage of the ballast and at the lowest and highest rated input voltage of the ballast.

Throughout the lifetime of the lamp, ballast curve must fall within the specified limits of the lamp voltage and wattage.

Ballast for luminaires must be located in the luminaire housing.

#### 86-6.01A(1) Regulator Type Ballasts

Regulator type ballast must comply with the following:

1. For nominal input voltage and lamp voltage, ballast design center must not vary more than 7.5 percent from rated lamp wattage.
2. Ballast must be designed for a capacitance variance of  $\pm 6$  percent that will not cause more than  $\pm 8$  percent variation in lamp wattage regulation during rated lamp life.
3. Lamp current crest factor must not exceed 1.8 for input voltage variation of  $\pm 10$  percent at any lamp voltage during lamp life.

Regulator-type ballast must be one of the following:

**Regulator-Type Ballast**

Ballast Type	Power Factor	Lamp Regulation
Lag-type <sup>a</sup>	Not less than 90 percent throughout the life of lamp when ballast is operated at nominal line voltage with a nominally-rated reference lamp	Lamp wattage regulation spread does not vary by more than 18 percent for ±10 percent input voltage variation from nominal through life
Lead-type <sup>b</sup>	Not less than 90 percent throughout the life of lamp when ballast is operated at nominal line voltage with a nominally-rated reference lamp	Lamp wattage regulation spread does not vary by more than 30 percent for ±10 percent input voltage variation from nominal through life

<sup>a</sup>Primary and secondary windings must be electrically isolated

<sup>b</sup>Constant wattage autoregulator (CWA)

**86-6.01A(2) Nonregulator Type Ballasts**

Each nonregulator type ballast must comply with the following:

1. For nominal input voltage and lamp voltage, ballast design center must not vary more than 7.5 percent from rated lamp wattage.
2. Lamp current crest factor must not exceed 1.8 for input voltage variation of ±5 percent at any lamp voltage during lamp life.

**Nonregulator-Type Ballast**

Ballast Type	Power Factor	Lamp Regulation
Autotransformer or High-Reactance	Not less than 90 percent throughout the life of lamp when ballast is operated at nominal line voltage with a nominally-rated reference lamp	Lamp wattage regulation spread does not vary by more than 25 percent for ±5 percent input voltage variation from nominal through life

**86-6.01B High Pressure Sodium Lamps**

High pressure sodium lamps must comply with ANSI C 78.42, "High Pressure Sodium Lamps," when tested as specified in ANSI C 78.389, "American National Standard for Electric Lamps - High Intensity Discharge-Methods of Measuring Characteristics." High pressure sodium lamps must have a minimum average rated life of 24,000 hours.

**86-6.02 LOW PRESSURE SODIUM LUMINAIRES**

Each low pressure sodium luminaire must be completely assembled with a lamp and ballast, and must:

1. Be the enclosed type, either semi-cutoff or cutoff type.
2. Include housing, reflector, refractor or lens, lamp socket, integral ballast, removable ballast tray, lamp support, terminal strip, capacitor, and slip fitter. Reflector may be an integral part of the housing.

Luminaire housing must be minimum 1/16-inch thick, corrosion resistant die cast aluminum sheet and plate with concealed continuous welds, or minimum nominal wall thickness of 3/32-thick acrylonitrile-butadiene-styrene sheet material, on a cast aluminum frame that provides mounting for all electrical components and slip fitter. Housing must be divided into optical and power compartments that are individually accessible for service and maintenance. Position and clamp luminaire to pipe tenon by tightening mounting bolts.

Painted exterior surface of luminaire must be finished with a fused coating of electrostatically applied polyester powder paint or other ultraviolet inhibiting film. Color must be aluminum gray.

High temperature neoprene, or equal, sealing ring must be installed in pipe tenon opening to prevent entry of water and insects into power and optical compartments.

Access to power unit assembly must be through a weathertight hinged cover, secured with spring type latches or captive screws, to luminaire housing.

Hardware must be stainless steel or cadmium plated. Use machine screws or bolts to secure removable components. Do not use sheet metal screws.

Semi-cutoff luminaires and molded refractor style cutoff luminaires must include a refractor. Other cutoff luminaires must include a flat lens.

Refractor must be 1-piece injection molded polycarbonate of 3/32 inch minimum thickness, or 1-piece injection molded acrylic of 1/8 inch minimum thickness. Flat lens must be 1-piece polycarbonate of 3/32 inch minimum thickness, mounted to metal frame. Refractor assembly and flat lens assembly must be constructed to rigidly maintain its shape, and hinged and secured with spring type latches to luminaire housing. Alternate methods of manufacturing refractor may be approved provided minimum specified thicknesses are maintained.

Lamp socket must be high temperature, flame retardant thermoset material with self-wiping contacts or equivalent. Socket must be rated for 660 W and 1,000 V(ac). Position of socket and support must maintain the lamp in correct relationship with reflector and refractor for designed distribution pattern.

Isofootcandle distribution must be ANSI Type III, short or Type IV, medium distribution, for cutoff or semi-cutoff luminaires.

With a 40-foot mounting height, each type of luminaire must maintain a minimum of 0.2 footcandle at least 60 feet each side, along the longitudinal roadway line below the luminaire, and a minimum of 0.35 footcandle at a transverse roadway distance from luminaire location equal to 1.5 times the luminaire mounting height.

Certified luminaire performance data must be provided. This data must include complete photometric test data in isofootcandle charts at a scale of 1 inch equals 20 feet, for the luminaire and lamp sizes shown on the plans.

Alternate data may be in horizontal footcandle values recorded on a 15' x 15' area extending 90 feet longitudinally each side of the light source, and 15 feet behind and 90 feet in front of the light source, for luminaire and lamp sizes, and mounting height shown on the plans. Horizontal footcandle levels in data submitted must equal or exceed levels specified. Failure to meet referenced values will be justification for rejection of the luminaires.

Photometric testing must be performed and certified by an independent and recognized testing laboratory.

Low pressure sodium lamps must:

1. Be 180 W, single-ended, bayonet base, tubular gas discharge lamp
2. Maintain a minimum of 93 percent of initial lumens during rated life and must comply with the following minimum performance requirements:

**Performance Requirements**

Lamp Designation	ANSI L74-RF-180
Initial Lumens	33,000 lumens
Rated Ave. Life (@ 10 hrs/Start)	18,000 hours
Operating Position	Horizontal ±20 degrees

3. Reach 80 percent of light output within 10 minutes and must restrike within 1 minute after an outage due to power interruption or voltage drop at the lamp socket
4. Identify the month and year of installation.
5. Have an autotransformer or high-reactance type ballast. The ballast must comply with the following:
  - 5.1. Lamp current crest factor must not exceed 1.8 at nominal line voltage
  - 5.2. Ballast loss must not exceed 24 percent for 180 W ballast at nominal line voltage

**Autotransformer or High-Reactance Type Ballast**

Ballast Type	Power Factor	Lamp Operation
Autotransformer or High-Reactance	Not less than 90 percent when ballast is operated at nominal line voltage with a nominally-rated reference lamp	Lamp wattage regulation spread does not vary by more than ±6 percent for ±10 percent input voltage variation from nominal through life

A multi-circuit connector must be included for quick disconnection of ballast tray.

**86-6.03 SOFFIT AND WALL LUMINAIRES**

Soffit and wall luminaire must be weatherproof and corrosion resistant.

Each flush-mounted soffit luminaire must consist of:

1. Metal body with two 1-inch minimum conduit hubs and provisions for anchoring into concrete
2. Prismatic refractor made of heat-resistant polycarbonate mounted in a door frame and clearly identified as to street side
3. Specular anodized aluminum reflector
4. Ballast located either within housing or in a ceiling pull box as shown on the plans

## 5. Lamp socket

The door frame assembly must be hinged, gasketed, and secured to body by at least 3 machine screws. Each pendant soffit luminaire must be enclosed and gasketed, have an aluminum finish, and include:

1. Reflector with a specular anodized aluminum finish
2. Refractor made of heat-resistant polycarbonate
3. Optical assembly hinged and latched for lamp access and a device to prevent dropping
4. Ballast designed for operation in a raintight enclosure
5. Galvanized metal box with a gasketed cover, 2 captive screws, and 2 chains to prevent dropping and for luminaire mounting

Each wall-mounted luminaire must consist of:

1. Cast metal body
2. Prismatic refractor, made of glass, mounted in a door frame
3. Aluminum reflector with a specular anodized finish
4. Integral ballast
5. Lamp socket
6. Gasket between refractor and body
7. At least two 5/16-inch minimum diameter mounting bolts

Cast-aluminum bodies to be cast into or mounted against concrete must have a thick application of alkali-resistant bituminous paint on all surfaces to be in contact with concrete.

Each soffit luminaire and wall luminaire must include a 70 W high-pressure sodium lamp with a minimum average rated life of 24,000 hours. Each lamp socket must be positioned to locate the light center of the lamp within 1/2 inch of light center location of the luminaire design.

Ballast must comply with Section 86-6.01A, "High Pressure Sodium Lamp Ballasts." Wall luminaire ballast must be located in luminaire housing or, if shown on the plans, in a pull box adjacent to luminaire.

### **86-6.04 PEDESTRIAN CROSSING FIXTURES**

Before starting fixture manufacturing, submit fixture design for approval. If requested, submit 1 complete prototype fixture for approval at least 30 days before manufacturing the fixtures. The prototype fixture will be returned to you, and if permitted, the fixture may be installed in the work.

Lens unit in door section must be formed of 1-1/2-inch methyl methacrylate rod cut and fire-glazed for a clear finish or a cast unit with equivalent tolerances and finish.

Lens must be secured to door section with an extruded lens retainer of 6063-T5 aluminum alloy that fits the lens shape. Lens retainer must fit the full length of lens on both sides. Continuous lens retainer for the full length of 3 lenses is allowed. Z bars of 5052-H32 or 5005-H14 aluminum alloy, 1/16 inch minimum thickness may be substituted for extruded lens retainer.

A captive positive-keyed screw-type latching device requiring a special socket wrench must be installed at upper edge to secure door in the closed position as shown on the plans. Furnish 2 special wrenches to the Engineer.

Each fixture must include a F48T12/CW rapid start fluorescent lamp with recessed, double contact base installed on back side of door directly behind lens.

Each lampholder must be UL listed for outdoor use without an enclosure and with 1,500 mA rapid start fluorescent lamp. Lampholder must be spring-loaded type.

For each lamp, the distance from face of lampholder to the lamp must be designed to provide a compression of at least 0.10-inch on the spring-type lampholder when lamp is in place. Lamp must have positive mechanical and electrical contact when lamp is in place. Socket on spring-type lampholder must have enough travel to allow lamp installation. Spring must not be a part of current-carrying circuit.

Ballast must be high-factor type with weatherproof leads for operation of one 48-inch rapid-start lamp. Ballast must be UL listed for outdoor operation on 110 to 125 V(ac) 60 Hz circuit and rated at 1,500 mA.

Conductors from ballast leads to lampholder must be minimum size of No. 16, stranded, and UL-listed copper AWM. Splicing of lampholder conductors to ballast leads must be performed by using mechanically secure connectors.

Conductors in fixture except ballast leads and entrance line conductors, must be UL-listed AWM.

Provide sufficient slack in the conductors to allow the fixture door to fully open.

Circuit conductors entering the fixture must be terminated on molded phenolic barrier-type terminal blocks rated at 15 A and 600 V(ac) and must have integral-type white waterproof-marking strips. Current-carrying parts of terminal blocks must be insulated from fixture with integral plugs or strips to provide protection from line-to-ground flashover voltage. Terminal

blocks must be attached to wireway cover in top section. If you use sectionalized terminal blocks, each section must include an integral barrier on each side and be capable of rigid mounting and alignment.

Exposed surfaces of fixture must be uniform in appearance and free from significant defects, including improper fit, dents, deep scratches and abrasions, burrs, roughness, off-square ends, holes off-center or jagged, and surface irregularities. Screws for attaching components to fixture door, including Z bars, ballasts, and terminal block, must be tapped into door from the inside only. Screwheads, nuts, or other fasteners must not be removable from the outside.

#### **86-6.04A Pedestrian Undercrossing Fixtures**

Fixture shell must be cast aluminum alloy, industrial type or Federal Class 18 aluminum of 1/4 inch minimum thickness.

Door must be 1 piece of 6061-T6 aluminum alloy of 1/8 inch minimum thickness.

Continuous piano hinge must be Type 1100 aluminum alloy. The piano hinge must be welded or riveted to door section with 1/8 inch aluminum rivets. Matching holes must be drilled in the hinge and lower edge of fixture. After shell is in place, door assembly must be attached by minimum 3/8-inch No. 8 stainless steel self-tapping screws.

A neoprene gasket must be attached to frame to provide a cushion between the shell and the door.

Chain or other device must be included to prevent the door, when fully opened, from coming in contact with the undercrossing wall.

Fixture must be held in place by three 3/8" x 8" anchor bolts with 2 nuts each.

Fixture surfaces in contact with concrete, and with anchor bolts and nuts must be painted with a thick application of alkali-resistant bituminous paint. Paint must comply with MIL-P-6883.

Circuit conductor entering the fixture must be terminated on 2-position terminal blocks.

Both ends of fixture must have holes for 1-inch conduit. Unused holes must be plugged with pressed metal closures.

#### **86-6.04B Pedestrian Overcrossing Fixtures**

Fixture shell must consist of:

1. Top section and a door section of extruded 6063-T5 aluminum alloy, each with a nominal 1/8 inch wall thickness
2. 2 cast-end sections of 319 aluminum alloy
3. Internal wireway cover of 505-H32 aluminum alloy

Top section and door section must be joined together on one side by a continuous hinge formed as part of the 2 extrusions and must overlay to allow locking on the other side. Hinge must be treated with a silicone grease that will prevent the entrance of water by capillary action.

Wireway cover with 3/16 inch hemmed ends up and terminal blocks and circuit conductors must be inserted before welding end sections and must provide clearance at both ends for conductors. Cover must be fastened by at least two 1/4 inch No. 4 self-threading sheet metal screws with binding head and blunt point. You may substitute blind rivets of equivalent strength.

One or more bronze sash chains or other device must be included to prevent door from opening to an extent that will damage the hinge.

Lampholder must include heat-resistant circular cross section neoprene sealing gasket, silver-coated contacts, and waterproofed lead entrance for use with a 1,500 mA rapid start fluorescent lamp.

Ballast must be at most 13-1/4 inches long.

Circuit conductors entering the fixture must be terminated on 3-position terminal blocks.

Electrical system of pedestrian overcrossing must be grounded by a No. 8 copper wire installed in conduit from fixture to fixture, from end fixture to conduit fitting on end post and from conduit fitting on end post to grounding bushing in nearest pull box.

Ground wire must be secured to inside of telescoping sleeve end casting where conductors are carried and to the inside of Type LB conduit fitting on end post by a connecting lug and a No. 8 self-threading pan screw.

Lamp, lampholder, ballast, and fixture wire, must be attached to door section. Terminal blocks must be attached to top section or wireway cover.

Three No. 10, solid copper circuit conductors must be installed between terminal blocks as part of each completed fixture.

Before shipment to job site, fixture must be completely manufactured and assembled in the shop.

#### **86-6.05 INDUCTION SIGN LIGHTING FIXTURES**

Each induction sign lighting fixture must include housing with door, reflector, refractor or lens, lamp, power coupler, high frequency generator, socket assembly, fuse block, and fuses.

Each induction sign lighting fixture must:

1. Be designed for mounting near the bottom of sign panel on an overhead sign structure.
2. Be an enclosed design and be raintight and corrosion resistant.
3. Have a minimum average rating of 60,000 hours.
4. Be for a wattage of 87 W, 120/240 V(ac).
5. Have a power factor greater than 90 percent and total harmonic distortion less than 10 percent.
6. Be UL approved for wet locations and be FCC Class A-listed.
7. Not exceed 44 pounds in weight.
8. Include the manufacturer's brand name, trademark, model number, serial number, and date of manufacture on packaged assembly. Same information must be permanently marked on the outside and inside of housing.
9. Comply with minimum horizontal footcandle requirement shown on the plans.
10. Be a maximum height of 12 inches above the top of the mounting rails.

If fixture is located so that the light center of the lamp is 55 inches in front of, 1 foot below, and centered on a 10-foot high by 20-foot wide sign panel, the ratio of maximum to minimum illuminance level on the panel must not exceed 12 to 1 in 95 percent of the points measured. Illuminance gradient must not exceed 2 to 1 and is defined as the ratio of minimum illuminance on a 1-foot square of panel to that on an adjacent 1-foot square of panel.

Each fixture must have a mounting assembly that will allow fixture to be mounted on continuous slot channels. Mounting assembly must be either cast aluminum, hot-dip galvanized steel plate, or steel plate that has been galvanized and finished with a polymeric coating system or same finish that is used for housing.

Housing must have a door designed to hold a refractor or lens, and to open without the use of special tools. Housing and door must be manufactured of sheet or cast aluminum, and have a powder coat or polyester paint finish of a gray color resembling unfinished manufacturing. Sheet aluminum must comply with ASTM B 209 or B 209M for 5052-H32 aluminum sheet. External bolts, screws, hinges, hinge pins, and door closure devices must be corrosion resistant.

Housing must include weep holes.

Door must be hinged to housing on side of fixture away from the sign panel and include 2 captive latch bolts or other latching device. Door must be designed to lock in the open position, 50 degrees minimum from the plane of the door opening, with an 85-mph 3-second-wind-gust load striking the door from either side.

Door and housing must be gasketed to be raintight and dusttight. Thickness of gasket must be 1/4 inch, minimum.

Fixture height must be less than 12 inches above the top of mounting rails.

Reflector must be 1 piece, made from specularly finished aluminum protected with an electrochemically applied anodized finish or a chemically applied silicate film, and designed so deposited water due to condensation will drain away. Reflector must be secured to housing with a minimum of 2 screws and removable without removing any fixture parts. Do not attach reflectors to outside of housing.

Refractor or lens must have a smooth exterior and must be manufactured from the material as follows:

#### **Refractor and Lens Material Requirements**

Component	Manufactured From
Flat lens	Heat-resistant glass
Convex lens	Heat resistant, high-impact resistant tempered glass
Refractor	Borosilicate heat resistant glass

Refractor and convex lens must be designed or shielded so no fixture luminance is visible if fixture is approached directly from the rear and viewing level is the bottom of the fixture. If a shield is used, it must be an integral part of the door casting.

Each fixture must include an 85 W induction lamp with an interior wall that is fluorescent phosphor-coated. Light output must be at least 70 percent at 60,000 hours. Lamp must have a minimum color-rendering index of 80, be rated at a color temperature of 4,000K and be removable without the use of tools.

Lamp socket must be a porcelain enclosed mogul type with a shell that contains integral lamp grips to assure electrical contact under normal vibration conditions. Center contact must be spring-loaded. Shell and center contact must be nickel-plated brass. Socket must be rated for 1,500 W and 600 V(ac).

Power coupler must include a construction base with antenna, heat sink, and electrical connection cable, and be designed so it can be removed with common hand tools.

High frequency generator must:

1. Start and operate lamps at an ambient temperature of -25 °C or greater for the rated life of the lamp
2. Operate continuously at ambient air temperatures from -25 °C to 25 °C without reduction in generator life
3. Have a design life of at least 100,000 hours at 55 °C

4. Have an output frequency of 2.65 MHz  $\pm$  10 percent
5. Have radio frequency interference that complies with FCC Title 47, Part 18, regulations regarding harmful interference
6. Be replaceable with common hand tools
7. Mounted so the fixture can be used as a heat sink

Conductor terminal must be identified by the component terminal the conductor connects to.

Submit a copy of the high frequency generator test methods and results from the manufacturer with each lot of fixtures.

Each fixture must include a barrier-type fuse block for terminating field connections. Fuse block must:

1. Be secured to housing and be accessible without removal of any fixture parts
2. Be mounted to leave a minimum of 1/2 inch air space from sidewalls of housing
3. Be designed for easy removal of fuses with a fuse puller, be rated at 600 V(ac), and have box terminals.

Fuses must be 13/32-inch diameter, 1-1/2 inch long ferrule type and UL or NRTL listed. For 120 V(ac) input fixture, only the ungrounded conductor must be fused and there must be a solid link between the neutral and the high frequency generator.

If shown on the plans, include a wire guard to prevent damage to the refractor or lens. Guard must be constructed of 1/4-inch minimum diameter galvanized steel wire, and either hot-dip galvanized or electroplated-zinc coated as specified in ASTM B 633, Service Condition SC4 with a clear chromate dip treatment. Guard elements must be spaced to prevent rocks larger than 1-1/2-inch diameter from passing through.

#### **86-6.06 SIGN LIGHTING FIXTURES FOR FLASHING BEACON**

Sign lighting fixture must:

1. Be UL or NRTL listed for outdoor installation
2. Include a hood with side outlet tapped for conduit, a symmetrical 10-inch steel reflector with a white porcelain-enamel finish, and a medium base socket
3. Be rated at 150 W minimum

#### **86-6.07 INTERNALLY ILLUMINATED STREET NAME SIGNS**

Sign fixture must be:

1. Designed and constructed to prevent deformation or failure when subjected to an 85 mph 3-second-wind-gust load as specified in AASHTO publication, "Standard Specifications for Structural Supports of Highway Signs, Luminaires and Traffic Signals," and its interim revisions
2. Manufactured from all new material and all ferrous parts must be galvanized or cadmium-plated
3. Type A or B signs

Top and bottom must be formed or extruded aluminum and must be attached to formed or cast aluminum end fittings. Housing must be designed for continuous sealing between top and bottom assemblies, and end fittings, and be constructed to resist torsional twist and warp. Opening or removing 1 panel must allow access to the interior of the sign for lamp, ballast, and fuse replacement.

Photoelectric unit sockets are not allowed.

For Type A sign, both sides must be hinged at the top to allow installation or removal of sign panel, and to allow access to interior of sign.

For Type B sign, sign panel must be slide-mounted into housing.

Reflectors may be used to obtain required sign brightness. Reflectors must be formed aluminum with acrylic baked white enamel surface having a minimum reflectance of 0.85.

Sign panel must be slide-mounted or rigid-mounted in a frame, with white legend, symbols, arrows, and border on each face. Background must be green.

Sign panels surface must be evenly illuminated. Average of brightness readings for letters must be 150 foot-lamberts, minimum. Light transmission factor of sign panel must provide a letter to background brightness ratio between 10 to 1 and 20 to 1. Background luminance must not vary by more than 40 percent from the average background brightness reading. Luminance of letters, symbols, and arrows must not vary by more than 20 percent from their average brightness readings.

Sign panels must be translucent, high impact, resistant plastic panels of one of the following:

1. Glass fiber reinforced acrylated resin
2. Polycarbonate resin

### 3. Cellulose acetate butyrate plastic

Paint on the outside of plastic must be protected by a plastic film that seals the front surface of panel and filters out ultraviolet radiation. Paint must be acrylic plastic type.

Surface must be free of blemishes in the plastic or coating that may impair the serviceability or detract from the general appearance and color matching of sign.

White or green color must not fade or darken when sign is exposed to an accelerated test of ultraviolet light equivalent to 2 years of outdoor exposure. Green color of sign, when not illuminated, must match Color No. 14109 of Federal Standard 595B.

Sign panel must not crack or shatter when a 1-inch diameter, steel ball with a weight of 2.4 ounces is dropped from a height of 8.5 feet above the sign panel to any point of sign panel. For this test, sign panel must be lying in a horizontal position and supported within its frame.

For Type A sign, gasket must be installed between sign panel frame and fixture housing to prevent water entry between frame and fixture housing. Gasket must be uniform and even-textured, and be the closed-cell, sponge-neoprene type, designed for use at temperatures between -20 °C and +74 °C.

Gasket must be neatly applied to thoroughly degreased, clean surface with a suitable heat-resistant adhesive that will not allow the gasket to slip at temperatures between -20 °C and +74 °C.

Ballast must be high power factor type and capable of starting the lamp at -20 °C and above.

Ballast for Type A sign must be rated at 200 mA. Ballasts for Type B sign must be rated at 430 mA. Ballast must be UL or NRTL listed for operation on 110 to 125 V(ac), 60 Hz circuits, and comply with ANSI C 82.1 and ANSI C 82.2.

Lampholder must be UL or NRTL listed for outdoor use and of the spring-loaded type. Lampholder must have silver-coated contacts and waterproofed entrance leads for use with a rapid-start fluorescent lamp. Removal of lamp from socket must de-energize the primary of ballast. Each lampholder must include heat-resistant, circular cross section, partially-recessed neoprene ring to seal against lamp ends and protect electrical contacts from moisture, dirt or other injurious elements.

Distance between face of lampholders must be designed to provide compression of at least 0.10 inch on the spring-type lampholder when lamp is in place. Lamp must have positive mechanical and electrical contact when lamp is in place. Socket on spring-type lampholder must have sufficient travel to allow lamp installation. Spring must not be a part of current carrying circuit. Lampholder must match lamp requirements and must not increase cathode filament circuit resistance by more than 0.10 Ω.

Lamp must comply with ANSI C 78.

Wiring connections in fixture must be terminated on molded, phenolic, barrier-type, terminal blocks rated at 15 A, 1,000 V(ac), and must have integral-type white waterproof-marking strips. Current carrying parts of terminal blocks must be insulated from fixture with integral plugs or strips to provide protection from line-to-ground flashover voltage. If you choose to use sectionalized terminal blocks, each section must include an integral barrier on each side and be capable of rigid mounting and alignment. Terminal screws must be No. 10, minimum.

Fuses must be Type 3AG, miniature, slow-blowing type with appropriate current and voltage ratings.

Fuseholder must be a panel-mounting type with threaded or bayonet-type knob that grips the fuse tightly for extraction. Use a separate fuse for each ballast.

Screened weep holes must be constructed at strategic locations in members subject to moisture collection.

Fasteners, screws, and hardware must be passive stainless steel, Type 302 or 304, or aluminum Type 6060-T6.

Top of fixture housing must have 2 free-swinging mounting brackets. Each bracket must be adjustable vertically for leveling the sign to either a straight or curved mast arm. Bracket assembly must allow fixture to swing perpendicular to the sign panel.

Hinge pins for the free-swinging brackets must have a minimum diameter of 1/4 inch.

Message, as shown on the plans, must be displayed on both sign panels.

If not shown on the plans, the message and the size of symbols or arrows will be given by the Engineer at your request. Letters must be 8-inch upper case and 6-inch lower case, Series E.

Fixture conductors must be UL- or NRTL-listed AWM stranded copper wire with 28 mils, minimum, thermoplastic insulation, rated at 1,000 V(ac) and rated for use at 90 °C. Conductors must be No. 16 minimum and must match color coding of ballast leads.

Conductors within the fixture must be secured with easily removable spring cross straps, not clamped, in the chassis or fixture. Straps must be installed 12 inches apart or less.

Stranded copper conductors connected to screw-type terminals must terminate in approved crimp-type ring connectors.

Splices are not allowed within fixture.

Submit shop drawings showing the message for each sign, including size of letters, symbols or arrows, as shown on the plans. If requested, you must supply, without cost to the State, sufficient samples of materials to be used in the manufacturing of the sign or a complete sign assembly, to allow adequate testing and evaluation of compliance to specified requirements.

## 86-6.08 PHOTOELECTRIC CONTROLS

Photoelectric controls must be capable of directly switching multiple lighting systems.

### 86-6.08A Types

Photoelectric control type must comply with the following:

**Photoelectric Control Types**

Type I	Includes a remote photoelectric unit and a test switch housed in an enclosure.
Type II	Includes a remote photoelectric unit, a separate contactor located in a service equipment enclosure, and a test switch located in service equipment enclosure.
Type III	Includes a remote photoelectric unit, a separate contactor, and a test switch housed in an enclosure.
Type IV	Includes a photoelectric unit that plugs into an EEI-NEMA twist-lock receptacle integral with the luminaire.
Type V	Includes a photoelectric unit, contactor, and test switch located in service equipment enclosure.

A switch to allow manual operation of lighting circuit must be included for each Type I, Type II, Type III, and Type V photoelectric control. Switches must be single-hole mounting toggle type, single-pole, single-throw, rated at 12 A with a voltage rating that matches the circuit. Switches must have an indicating nameplate reading "Auto-Test" and be connected in parallel with the load contacts of the photoelectric unit. Test switches must not have an "OFF" position.

Photoelectric unit for Types I, II, and III photoelectric controls, must be pole-top mounted.

### 86-6.08B Equipment Details

#### 86-6.08B(1) Photoelectric Unit

Photoelectric unit must:

1. Have an output in response to changing light levels. Response level must remain stable throughout life of control unit.
2. Have a "turn-on" between 1 and 5 footcandles, and a "turn-off" between 1.5 and 5 times "turn-on." Measurements must be made by procedures in EEI-NEMA standards for physical and electrical interchangeability of light-sensitive control devices used in the control of roadway lighting.
3. Have a EEI-NEMA type receptacle. Mounting brackets must be used where pole-top mounting is not possible. Photoelectric controls must be installed at locations show on the plans and oriented.
4. Be screened to prevent artificial light from causing cycling.
5. Have a supply voltage rating of 60 Hz, 105-130 V(ac), 210-240 V(ac), or 105-240 V(ac), as specified.
6. Have a load rating of 800 W minimum, incandescent, high intensity discharge, or fluorescent.
7. Operate at a temperature range of -20 °C to 55 °C.
8. Have a power consumption less than 10 W.
9. Be housed in a weatherproof enclosure.
10. Have a base with a 3-prong, EEI-NEMA standard, twist-lock plug mounting.
11. Have a "fail-on" feature.

Unit components must not require periodic replacement.

Photoelectric controls, except Type IV and Type V, must include a 4-inch minimum inside diameter, pole-top mounting adaptor containing a terminal block, and cable supports or clamps to support pole wires.

For switching 480 V(ac), 60 Hz circuits, a 100 VA, minimum, 480/120 V(ac) transformer must be installed in the contactor enclosure to allow 120 V(ac) for the photoelectric control unit. If more than 1 photoelectric unit is to be installed at a location, a single transformer with a volt-ampere rating capable of handling the total controlled load, may be used.

#### 86-6.08B(2) Contactor

Contactor must:

1. Have contacts rated to switch the specified lighting load
2. Be normally open
3. Be the mechanical armature type with contacts of fine silver, silver alloy, or superior alternative material

**86-6.08B(3) Enclosure**

Enclosure for Type I and Type III photoelectric controls must be NEMA 3R. Enclosure must be supplied with a factory-applied rust-resistant prime coat and finish coat. Two applications of paint to match the color of the standard must be applied as specified in Section 86-2.16, "Painting." Enclosure may be hot-dip galvanized instead of painting. A minimum of 2-1/2 inches must be provided between contactor terminals and end of enclosure for wiring connections. Enclosure must be mounted on the same standard as the photoelectric unit at a height of about 6 feet above finished grade.

**86-6.08B(4) Terminal Blocks**

Terminal blocks must be rated at 25 A, 600 V(ac), molded from phenolic or nylon material, and of the barrier type with plated-brass screw terminals and integral-type marking strips.

**86-6.09 TRANSFORMERS**

Multiple-to-multiple transformers must be single-phase dry type designed for operation on a 60 Hz supply.

**86-6.09A Electrical Requirements**

Transformers must have a decal showing a connection diagram. Diagram must show either color-coding or wire-tagging with primary (H1, H2) or secondary (X1, X2) markers, and the primary and secondary voltage and volt-ampere rating. Transformers must comply with the following:

**Transformer Electrical Requirements**

Transformer Characteristic	Multiple-to-Multiple Unit
Rating	120/480 V(ac), 240/480 V(ac), or 480/120 V(ac)
Efficiency	Exceed 95 percent
Secondary Voltage Regulation and Tolerance	±3 percent from half load to full load

Secondary 480 V(ac) windings must be center-tapped.

**86-6.09B Physical Requirements**

External leads for multiple-to-multiple secondary connections must be Type USE, No. 10, rated 600 V(ac).

Transformer leads must extend a minimum of 12 inches from the case.

Transformer insulation must be NEMA 185 C or better.

Multiple-to-multiple transformers must withstand the application of 2,200 V(ac) from core to coils and from coil to coil for a 1-minute period.

The above tests must be made immediately after operation of transformer at full load for 24 hours.

Non-submersible transformers must include metal half-shell coil protection, have moisture resistant synthetic varnish impregnated windings, and be suitable for outdoor operation in a raintight enclosure.

Each transformer to be installed in a pull box must be the submersible type and include a handle and a hanger.

**86-6.09C Submersible Type Transformers**

Submersible type transformers must be securely encased in a rugged corrosion resistant, watertight case and must withstand a 5-day test submerged in 2 feet of salt water, 2 percent salt by weight, with 12-hour on and off periods. The operating periods must be at full load.

Leads of submersible transformers must be brought out through one or more sealed hubs and secured to withstand a 100 pound static pull without loosening or leaking.

**86-6.10 (BLANK)**

**86-6.11 FALSEWORK LIGHTING**

**86-6.11A General**

Falsework lighting must include lighting to illuminate the pavement, portals, and pedestrian walkways at or under openings in the falsework required for traffic.

Lighting for pedestrian walkway illumination must be installed at all pedestrian openings through or under falsework.

Before starting falsework opening construction, you must submit a plan of proposed lighting installations for review and obtain approval. Approval will be made as specified in Section 5-1.02, "Plans and Working Drawings."

You must design falsework lighting so that required maintenance can be performed with a minimum of inconvenience to public traffic. Closing of traffic lanes for routine maintenance will not be permitted on roadways with posted speed limits greater than 25 mph.

Pavement under falsework with portals less than 150 feet apart and falsework portals must be illuminated only during the hours of darkness as defined in Division 1, Section 280, of the California Vehicle Code. Photoelectric switches must be used to control falsework lighting systems. Pavement under falsework with portals 150 feet or more apart and all pedestrian openings through falsework must be illuminated 24 hours per day.

Lighting fixtures must be aimed to avoid glare to oncoming motorists.

Type NMC cable with No. 12 minimum conductors, with ground wire, must be used. Fasten cable to supporting structure at sufficient intervals to adequately support cable and within 12 inches from every box or fitting. Conductors within 8 feet of ground must be enclosed in a 1/2 inch or larger metal conduit.

Each illumination system must be on a minimum of 1 separate branch circuit at each bridge location. Each branch circuit must be fused, not to exceed 20 A.

For falsework lighting, you must arrange with the serving utility to complete service connections. You must pay for energy, line extension, service, and service hookup costs.

At completion of project or when ordered by the Engineer, falsework lighting equipment will become your property and you must remove it from the job site.

You may propose a lighting plan that fulfills light intensity requirements to the systems specified herein. You must supply sufficient data to allow evaluation of alternative methods.

### **86-6.11B Pavement Illumination**

Illumination of pavement at vehicular openings through falsework must comply with the following:

1. Fixture must include R/FL commercial type floodlamp holder with protective covers.
2. Fixture must be fully adjustable with brackets and locking screws, and allow mounting directly to a standard metal junction box.
3. Lamp must be medium-base 120 V(ac), 120 W, minimum, PAR-38 quartz-halogen floodlamp.
4. A continuous row of fixture types required must be installed at locations and spacing specified. Fixtures must be installed beneath falsework structure, with the end fixtures not further than 10 feet inside portal faces. Fixtures must be installed and energized immediately after the members supporting them have been erected.
5. Fixtures along the sides of the opening must be placed not more than 4 feet behind or 2 feet in front of the roadway face of the temporary railing. Mounting heights of fixtures must be between 12 and 16 feet above the roadway surface and must present an unobstructed light pattern on the pavement.

### **86-6.11C Portal Illumination**

Illumination of falsework portals must comply with the following:

1. On each side of each entrance portal, plywood sheet clearance guides, 4 feet wide by 8 feet high, must be fastened vertically, facing traffic, with the bottom of the panel 3 feet to 4 feet above the roadway. The center of the panel must be located approximately 3 feet horizontally behind the roadway face of the railing. Panels must be freshly painted for each installation with not less than 2 applications of flat white paint. Paint testing will not be required.
2. If ordered by the Engineer, in order to improve the general appearance of the painted surfaces, you must repaint designated areas and that painting will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."
3. Falsework portals must be illuminated on the side facing traffic with 150 W, minimum, PAR reflector floodlamps mounted on the structure directly over each vertical support adjacent to the traveled way, as needed to uniformly illuminate the exterior falsework beam, the clearance guides, and the overhead clearance sign. Each lamp must be supported approximately 16 feet above the pavement and approximately 6 feet in front of the portal face.
4. Portal lighting and clearance guides must be installed on the day that vertical members are erected.

### **86-6.11D Pedestrian Walkway Illumination**

Illumination of pedestrian openings through or under falsework must comply with the following:

1. Fixtures must be flush-mounted in the overhead protection shield and equipped with a damage-resistant clear polycarbonate diffuser lens. Lamps must be standard incandescent 100 W, 120 V(ac).
2. Fixtures must be centered over the passageway at intervals of not more than 15 feet with the end fixtures not more than 7 feet inside the end of the pedestrian openings.
3. Pedestrian passageway light systems must be installed immediately after the overhead protection shield is erected.

## **86-7 REMOVING, REINSTALLING OR SALVAGING ELECTRICAL EQUIPMENT**

### **86-7.01 REMOVING ELECTRICAL EQUIPMENT**

Existing electrical equipment, pull boxes, and conduits, to be removed and not reused or salvaged, become your property and you must dispose of it under Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way." Unused underground conduit may be abandoned in place after all conductors have been removed, except that conduit terminations from conduit to be abandoned must be removed from pull boxes to remain.

Exercise care in salvaging equipment so that it will not be damaged or destroyed. Mast arms must be removed from standards. Luminaires, signal heads, and signal mounting assemblies must be removed from standards and mast arms.

Holes resulting from removing pull boxes must be filled with material equivalent to the surrounding material.

### **86-7.02 REINSTALLING REMOVED ELECTRICAL EQUIPMENT**

If removed electrical equipment is to be reinstalled, you must supply all necessary materials and equipment, including signal mounting assemblies, anchor bolts, nuts, washers, and concrete as required to complete the new installation.

Luminaires to be reinstalled must be cleaned and relamped.

Existing materials required to be reused and found to be unsatisfactory by the Engineer must be replaced with new material and the replacement cost will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

## **86-8 PAYMENT**

### **86-8.01 PAYMENT**

The contract lump sum price or prices paid for signal, ramp metering, flashing beacon, lighting, sign illumination, traffic monitoring station, highway advisory radio systems, closed circuit television systems, or combinations thereof; for modifying or removing those systems; for temporary systems; or the lump sum or unit prices paid for various units of those systems; or the lump sum or per foot price paid for conduit of the various sizes, types, and installation methods listed in the Engineer's Estimate include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing and installing, modifying, or removing the systems, combinations or units thereof, including any necessary pull boxes (except if the type required is shown as a separate contract item); excavation and backfill; concrete foundations (except if shown as a separate contract item); pedestrian barricades; furnishing and installing illuminated street name signs; installing sign panels on pedestrian barricades, on flashing beacon standards, and on traffic signal mast arms; restoring sidewalk, pavement and appurtenances damaged or destroyed during construction; salvaging existing materials; and making all required tests, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

If poles for electrical systems are manufactured from a source located more than 300 air-line miles from Sacramento and Los Angeles, the Department will deduct \$5,000 for inspection costs for each inspection site. If poles for electrical systems are manufactured from a source located more than 3,000 air-line miles from Sacramento and Los Angeles, the Department will deduct \$8,000 for inspection costs for each inspection site.

Full compensation for all additional materials and labor, not shown on the plans or specified, that are necessary to complete the installation of the various systems, is included in the prices paid for the systems, or units thereof, except as provided in Section 86-1.06, "Maintaining Existing and Temporary Electrical Systems," and no additional compensation will be allowed therefor.

If shown as a contract item, the contract price paid per foot for cast-in-drilled-hole concrete pile (signal foundation) includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing reinforced concrete pile foundations of the size shown on the Engineer's Estimate, including drilling holes, disposing of the material resulting from drilling holes, furnishing and placing anchor bolt assemblies and reinforcing steel, complete in place, as shown on the plans, and as specified in these specifications and the special provisions, and as directed by the Engineer.

If shown as a contract item, non-reinforced PCC foundations will be measured and paid for by the cubic yard for foundation concrete in the same manner as specified for minor concrete (minor structure) in Section 51, "Concrete Structures."

If shown as a separate contract item by the lump sum or per foot, interconnection conduit and cable includes all interconnection conductors, and conduit and pull boxes containing interconnection cable and no other conductors. The quantity of interconnection conduit and cable to be paid for by the foot is the length of that conduit. Compensation for conduit containing interconnection cable and other conductors is included in the contract price paid for the item requiring the other conductors.

Full compensation for furnishing, installing, maintaining, and removing falsework lighting equipment is included in the contract prices paid for the items of work involved in the structure that requires the falsework lighting and no additional compensation will be allowed therefor.



<b>Filter Fabric</b>				
Property	ASTM	Specification		
		Class A	Class B	Class C
Grab breaking load, 1-inch grip, lb minimum in each direction	D 4632	157		
Apparent elongation, percent minimum in each direction	D 4632	50		
Hydraulic bursting strength, psi minimum	D 3786	210		
Ultraviolet resistance, percent minimum retained grab breaking load, 500 hr	D 4355	70		
Permittivity, sec <sup>-1</sup> minimum	D 4491	0.5	0.2	0.1
Apparent opening size, average roll value, U.S. Standard sieve size maximum	D 4751	40	60	70

### 88-1.03 DRAINAGE

#### 88-1.03A Geocomposite Wall Drain

Geocomposite wall drain must consist of a polymeric core with filter fabric integrally bonded to 1 or both sides of the core creating a stable drainage void.

Filter fabric must comply with Section 88-1.02, "Filtration."

Geocomposite wall drain must comply with:

<b>Geocomposite Wall Drain</b>		
Property	ASTM	Specification
Thickness with fabric, inches maximum	--	2
Transmissivity, gradient = 1.0, normal stress = 5,000 psf, gal/min/ft	D 4716	4

### 88-1.04 REINFORCEMENT

#### 88-1.04A Geotechnical Subsurface Reinforcement

##### General

Geosynthetic used for geotechnical subsurface reinforcement must be either of the following:

1. Geotextile
2. Geogrid

Geotextile permittivity must be at least 0.05 sec<sup>-1</sup> determined under ASTM D 4491.

Geogrid must have a regular and defined open area. The open area must be from 50 to 90 percent of the total grid area.

##### Long Term Design Strength

Long Term Design Strength (LTDS) of geosynthetic reinforcement is the ultimate tensile strength in the primary strength direction divided by reduction factors. Calculate the LTDS from the guidelines in Geosynthetic Research Institute (GRI) Standard Practice GG4a, GRI GG4b, or GRI GT7.

The product of the appropriate reduction factors must be at least 1.30. Determine the reduction factor for creep using a 75-year design life for permanent applications and a 5-year design life for temporary applications. Determine the installation damage reduction factor based on the characteristics of the backfill materials used.

If test data is not available, use default values of reduction factors in the GRI Standard Practice to calculate LTDS.

Submit the LTDS and its supporting calculations at least 15 days before placing geosynthetic reinforcement. Do not install before the Engineer's approval. The LTDS must be signed by an engineer who is registered as a civil engineer in the State.

**88-1.05 WATER POLLUTION CONTROL**

Geosynthetics used for water pollution control must comply with:

**Water Pollution Control Geosynthetics**

Property	ASTM	Application				
		Silt Fence		Sediment Filter Bag	Gravel-Filled Bags	Temporary Cover
		Woven	Non-woven			
Grab breaking load, 1-inch grip, lb minimum in each direction	D 4632	120	120	255	205	200
Apparent elongation, percent minimum, in each direction	D 4632	15	50	--	--	50
Water flow rate, gallons per minute/square foot minimum and maximum average roll value	D 4491	10 - 100	100 - 150	80 - 200	80 - 150	75 - 120
Permittivity, sec <sup>-1</sup> minimum	D 4491	0.1	1.1	1.0	0.2	1.0
Apparent opening size, inches maximum average roll value	D 4751	0.023	0.023	0.033	0.016	0.007
Ultraviolet resistance, percent minimum retained grab breaking load, 500 hr.	D 4355	70	70	70	70	70

**88-1.06 CHANNEL AND SHORE PROTECTION**

**88-1.06A Rock Slope Protection**

Rock slope protection (RSP) fabric must be a permeable, nonwoven, needle-punched geotextile. RSP fabric consists of 1 of the following:

1. Polyester
2. Polypropylene
3. Combined polyester and polypropylene

Polymers must be either virgin compounds or clean reworked material. Do not subject virgin compounds to use or processing other than required for initial manufacture. Clean reworked material must be previously processed material from the processor's own production that has been reground, pelletized, or solvated. RSP fabric must not consist of more than 20 percent by weight of clean reworked material. Do not use recycled materials from either post-consumer or post-industrial sources.

Class 8 or Class 10 RSP fabric must comply with:

**Rock Slope Protection Fabric**

Property	ASTM	Specification	
		Class 8	Class 10
Weight, oz/yd <sup>2</sup> minimum	D 5261	7.5	9.5
Grab breaking load, lb 1-inch grip, min. in each direction	D 4632	200	250
Apparent elongation, percent min., in each direction	D 4632	50	50
Permittivity, sec <sup>-1</sup> , minimum	D 4491	1.0	0.70
Apparent opening size, U.S. Standard sieve size minimum and maximum	D 4751	70 - 100	70 - 100
Ultraviolet resistance, percent minimum retained grab breaking load, 500 hr.	D4355	70	70

**88-1.07 PAVEMENT INTERLAYER**

**88-1.07A Paving Fabric**

Geosynthetics used for paving fabric must be nonwoven. Paving fabric must comply with:

**Geosynthetic Paving Fabric**

Property	ASTM	Specification
Mass per unit area, oz/yd <sup>2</sup> minimum	D 5261	4.1
Grab breaking load, lb 1-inch grip, minimum, in each direction	D 4632	100
Apparent elongation, percent minimum in each direction	D 4632	50
Hydraulic bursting strength, psi minimum	D 3786	200
Melting point, °F minimum	D 276	325
Asphalt retention, gal/yd <sup>2</sup> minimum	D 6140	0.2

**88-1.07B Paving Mat**

Geosynthetics used for paving mat must be a nonwoven fiberglass and polyester hybrid material. Paving mat must comply with:

**Geosynthetic Paving Mat**

Property	ASTM	Specification
Breaking force, lb/2 inches minimum	D 5035	45
Ultimate elongation, percent maximum	D 5035	5
Mass per unit area, oz/ sq yd minimum	D 5261	3.7
Melting point, °F minimum	D 276	400
Asphalt retention, gal/yd <sup>2</sup> minimum	D 6140	0.10

### 88-1.07C Paving Grid

Geosynthetics used for paving grid must be a geopolymer material formed into a grid of integrally connected elements with openings. Paving grid must comply with:

Property	Test	Specification		
		Class I	Class II	Class III
Tensile strength at ultimate, lb/in <sup>a</sup> minimum	ASTM D 6637	560 x 1,120	560	280
Aperture size, inch minimum	Calipered	0.5	0.5	0.5
Elongation, % maximum	ASTM D 6637	12	12	12
Mass per area, oz / sqyd minimum	ASTM D 5261	16	10	5.5
Melting point, °F minimum	ASTM D 276	325	325	325

Note:

<sup>a</sup> For Class I, machine direction x cross direction. For Class II and Class III, both directions.

### 88-1.07D Paving Geocomposite Grid

Paving geocomposite grid consists of paving grid specified under Section 88-1.07C, "Paving Grid," bonded or integrated with paving fabric specified under Section 88-1.07A, "Paving Fabric."

Paving geocomposite grid must have a peel strength of at least 10 pounds per foot determined under ASTM D 413.

### 88-1.07E Geocomposite Strip Membrane

Geocomposite strip membrane must consist of various widths of strips manufactured from of asphaltic rubber and geosynthetics. Geocomposite strip membrane must comply with:

Property	ASTM	Specification
Strip tensile strength, lbs/inch minimum	D 882	50
Elongation at break, % minimum	D 882	50
Resistance to puncture, lbs. minimum	E 154	200
Permeance, perms maximum	E 96/E 96M	0.10
Pliability, 1/4 inch mandrel with sample conditioned at 25 °F	D 146	No cracks in fabric or bitumen
Melting point, °F	D 276	325

## 88-1.08 SEPARATION AND STABILIZATION

### 88-1.08A Subgrade Enhancement Geotextile

Subgrade enhancement geotextile must consist of either of the following:

1. Polyester
2. Polypropylene

Subgrade enhancement geotextile must comply with:



Use	Cementitious Material Content (Pounds/CY)
Concrete designated by compressive strength:	
Deck slabs and slab spans of bridges	675 min., 800 max.
Roof sections of exposed top box culverts	675 min., 800 max.
Other portions of structures	590 min., 800 max.
Concrete not designated by compressive strength:	
Deck slabs and slab spans of bridges	675 min.
Roof sections of exposed top box culverts	675 min.
Prestressed members	675 min.
Seal courses	675 min.
Other portions of structures	590 min.
Concrete for precast members	590 min., 925 max.

Except for minor structures, the minimum required compressive strength for concrete in structures or portions of structures shall be the strength specified, or 3600 pounds per square inch at 28 days, whichever is greater.

Except for when a modulus of rupture is specified, the minimum required compressive strength for concrete shall be the strength specified, or 2,500 pounds per square inch, whichever is greater. Concrete shall be proportioned such that the concrete will attain the minimum required compressive strength.

If the specified 28-day compressive strength is 3,600 pounds per square inch or greater, the concrete is designated by compressive strength. For concrete with a 28-day compressive strength greater than 3,600 pounds per square inch, 42 days will be allowed to obtain the specified strength.

For concrete not designated by compressive strength, the Engineer may test the concrete for compressive strength. The concrete will be accepted if the compressive strength at 28 days attains 85 percent or more of the minimum required compressive strength.

Concrete shall be proportioned to conform to the following shrinkage limitations when tested in conformance with the requirements of AASHTO Designation: T 160, modified as follows:

Condition	Maximum Shrinkage of Laboratory Cast Specimens at 28 days Drying (average of 3, %)
Paving and approach slab concrete	0.050
Bridge deck concrete	0.045

Note: Shrinkage requirement is waived for concrete that is used for precast elements.

Shrinkage tests shall be either:

- A. Performed by a laboratory accredited to perform AASHTO Designation: T 160, or
- B. Performed by a laboratory that maintains a current rating of 3 or better for the Cement and Concrete Reference Laboratory (CCRL) concrete proficiency sample program.

Laboratory cast specimens shall have a 4" x 4" cross section. Specimens shall be removed from the molds 23 ± 1 hours after mixing the concrete and placed in lime water at 73 ± 3 °F to 7 days age. A comparator reading shall be taken at 7 days age and recorded as the initial reading. Specimens then shall be stored in a humidity controlled room maintained at 73 ± 3 °F and 50 ± 4 percent relative humidity for the remainder of the test. Subsequent readings shall be taken at 7, 14, 21, and 28 days drying.

Test data verifying conformance to the shrinkage limitations shall be submitted with the mix design. Shrinkage testing data accepted by the Engineer no more than 3 years prior to the first working day of this contract will be acceptable for this entire contract, provided the data was for concrete with similar proportions and the same materials and material sources to be used on this contract. Concrete shall be considered to have similar proportions if, when compared to concrete to be used on this project, no more than 2 mix design elements are varied. Varied mix design elements shall fall within the tolerances in the following table:

Mix Design Element	Tolerance ( $\pm$ )
Water to cementitious material ratio	0.03
Total water content	5 %
Coarse aggregate (weight per cubic yard)	10 %
Fine aggregate (weight per cubic yard)	10 %
Supplementary cementitious material content	5 %
Admixture (as originally dosed)	25 %

Note: Admixtures must be of the same brand.

Before using concrete or in advance of revising the mix proportions, the Contractor shall submit in writing to the Engineer a copy of the mix design.

Compliance with cementitious material content requirements will be verified in conformance with procedures described in California Test 518 for cement content. For testing purposes, supplementary cementitious material (SCM) shall be considered to be cement. Batch proportions shall be adjusted as necessary to produce concrete having the specified cementitious material content.

If any concrete has a cementitious material, portland cement, or SCM content that is less than the minimum required, the concrete shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place and the Contractor shall pay to the State \$0.25 for each pound of cementitious material, portland cement, or SCM that is less than the minimum required. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract. The deductions will not be made unless the difference between the contents required and those actually provided exceeds the batching tolerances permitted by Section 90-5, "Proportioning." No deductions will be made based on the results of California Test 518.

The requirements of the preceding paragraph shall not apply to minor concrete.

## 90-2 MATERIALS

### 90-2.01 CEMENTITIOUS MATERIALS

Unless otherwise specified, cementitious material shall be either a combination of Type II or Type V portland cement and SCM, or a blended cement. No cementitious material shall be used in the work unless it is on the Department's Pre-Qualified Products List at the time of mix design submittal. Information regarding cementitious material qualification and placement on the Department's approved list can be obtained at the Transportation Laboratory.

Cementitious materials used in cast-in-place concrete for exposed surfaces of like elements of a structure shall be from the same sources and of the same proportions.

Cementitious materials shall be protected from moisture until used. Sacked cementitious materials shall be piled to permit access for tallying, inspecting, and identifying each shipment.

Facilities shall be provided to ensure that the various cementitious materials meeting this Section 90-2.01 are kept separate from each other and from other cementitious materials. A storage silo containing a cementitious material shall be emptied before using that silo for a different cementitious material. Blended cements with a percentage of SCM differing by more than 2 percentage points are considered different cementitious materials. Sampling cementitious materials shall be in conformance with California Test 125.

The Contractor shall furnish a Certificate of Compliance for cementitious materials in conformance with the provisions in Section 6-1.07, "Certificates of Compliance." The Certificate of Compliance shall indicate the source by name and location (including country, state, and city). If cementitious material is delivered directly to the job site, the Certificate of Compliance shall be signed by the cementitious material supplier. If the cementitious material is used in ready-mixed concrete or in precast concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of the concrete or product. If blended cement is used, the Certificate of Compliance shall include a statement signed by the blended cement supplier that indicates the actual percentage, by weight, of SCM in the blend. Weight of SCM shall be by weighing device conforming to Section 9-1.01, "Measurement of Quantities," or as determined by chemical analysis.

#### 90-2.01A Cement

Portland cement shall conform to the requirements in ASTM Designation: C 150 except the  $C_3S$  content of Type II cement shall not exceed 65 percent.

Blended cement shall conform to the requirements for Portland Blast-Furnace Slag Cement, Type IS (MS) or Portland-Pozzolan Cement, Type IP (MS) in AASHTO Designation: M 240, except that the maximum limits on the pozzolan content shall not apply. Blended cement shall be comprised of Type II or Type V cement and SCM produced by intergrinding portland cement clinker and granulated blast furnace slag, ground granulated blast furnace slag (GGBFS), or pozzolan; by blending portland cement and either GGBFS or finely divided pozzolan; or by a combination of intergrinding and blending.

In addition, Type II portland cement and Type V portland cement shall conform to the following requirements:

- A. The cement shall not contain more than 0.60-percent by mass of alkalis, calculated as the percentage of Na<sub>2</sub>O plus 0.658 times the percentage of K<sub>2</sub>O, when determined by methods as required in AASHTO Designation: T 105; and
- B. The autoclave expansion shall not exceed 0.50-percent

Type III portland cement shall be used only as specified or with the approval of the Engineer. Type III portland cement shall conform to the additional requirements listed above for Type II portland cement. The Contractor may use Type III portland cement in the manufacturing of precast concrete.

**90-2.01B Supplementary Cementitious Materials**

Each supplementary cementitious material shall conform to one of the following:

- A. Fly ash conforming to the requirements in AASHTO Designation: M 295, Class F, and these specifications. The available alkali, as sodium oxide equivalent, shall not exceed 1.5 percent when determined in conformance with the requirements in ASTM Designation: C 311 or the total alkali, as sodium oxide equivalent, shall not exceed 5.0 percent when determined in conformance with the requirements in AASHTO Designation: T 105.
- B. Ultra fine fly ash (UFFA) conforming to the requirements in AASHTO Designation: M 295, Class F, and the following chemical and physical requirements:

Chemical Requirements	Percent
Sulfur Trioxide (SO <sub>3</sub> )	1.5 max.
Loss on ignition	1.2 max.
Available Alkalies (as Na <sub>2</sub> O) equivalent	1.5 max.

Physical Requirements	Percent
Particle size distribution	
Less than 3.5 microns	50
Less than 9.0 microns	90
Strength Activity Index with portland cement	
7 days	95 (minimum % of control)
28 days	110 (minimum % of control)
Expansion at 16 days when testing job materials in conformance with ASTM C 1567*	0.10 max.

\* In the test mix, Type II or Type V portland cement shall be replaced with at least 12% UFFA by weight.

- C. Raw or calcined natural pozzolans conforming to the requirements in AASHTO Designation: M 295, Class N, and the following requirements and these specifications. The available alkali, as sodium oxide equivalent, shall not exceed 1.5 percent when determined in conformance with the requirements in ASTM Designation: C 311 or the total alkali, as sodium oxide equivalent, shall not exceed 5.0 percent when determined in conformance with the requirements in AASHTO Designation: T 105.
- D. Metakaolin conforming to the requirements in AASHTO Designation: M 295, Class N, and the following chemical and physical requirements:

Chemical Requirements	Percent
Silicon Dioxide (SiO <sub>2</sub> ) + Aluminum Oxide (Al <sub>2</sub> O <sub>3</sub> )	92.0 min.
Calcium Oxide (CaO)	1.0 max
Sulfur Trioxide (SO <sub>3</sub> )	1.0 max.
Loss on ignition	1.2 max.
Available Alkalies (as Na <sub>2</sub> O) equivalent	1.0 max.

Physical Requirements	Percent
Particle size distribution Less than 45 microns	95
Strength Activity Index with portland cement 7 days 28 days	100 (minimum % of control) 100 (minimum % of control)

- E. Ground Granulated Blast Furnace Slag (GGBFS) conforming to the requirements in AASHTO Designation: M 302, Grade 100 or Grade 120.
- F. Silica Fume conforming to the requirements of AASHTO Designation: M 307, with reduction in mortar expansion of 80 percent, minimum, using the cement from the proposed mix design.

Commingling of fly ash from different sources at uncontrolled ratios is permissible only if the following criteria are satisfied:

- A. Sources of fly ash to be commingled shall each produce fly ash that conforms to the requirements in AASHTO Designation: M 295, Class F.
- B. Testing of the commingled product is the responsibility of the fly ash supplier.
- C. Each fly ash's running average of relative density shall not differ from any other by more than 0.25 at the time of commingling.
- D. Each fly ash's running average of loss on ignition shall not differ from any other by more than one percent at the time of commingling.
- E. The final product of commingled fly ash shall conform to the requirements in AASHTO Designation: M 295, Class F.

#### 90-2.01C Required Use Of Supplementary Cementitious Materials

##### General

The amount of portland cement and SCM used in portland cement concrete shall conform to the minimum cementitious material content provisions in Section 90-1.01, "Description," or Section 90-4.05, "Optional Use of Chemical Admixtures," and these specifications.

The SCM content in portland cement concrete shall conform to one of the following:

- A. Any combination of portland cement and at least one SCM, satisfying Equations (1) and (2):

Equation (1)

$$\frac{(25 \times UF) + (12 \times FA) + (10 \times FB) + (6 \times SL)}{MC} \geq X$$

Where:

- UF = Silica fume, metakaolin, or UFFA, including the amount in blended cement, pounds per cubic yard.
- FA = Fly ash or natural pozzolan conforming to the requirements in AASHTO Designation: M 295, Class F or N with a CaO content up to 10 percent, including the amount in blended cement, pounds per cubic yard.
- FB = Fly ash or natural pozzolan conforming to the requirements in AASHTO Designation: M 295, Class F or N with a CaO content greater than 10 percent and up to 15 percent, including the amount in blended cement, pounds per cubic yard.
- SL = GGBFS, including the amount in blended cement, pounds per cubic yard.
- MC = Minimum amount of cementitious material specified, pounds per cubic yard.
- X = 1.8 for innocuous aggregate, 3.0 for all other aggregate.

Equation (2)

$$MC - MSCM - PC \geq 0$$

Where:

MC = Minimum amount of cementitious material specified, pounds per cubic yard.

MSCM = The minimum sum of SCMs that satisfies Equation (1) above, pounds per cubic yard.

PC = The amount of portland cement, including the amount in blended cement, pounds per cubic yard.

- B. 15 percent of Class F fly ash with at least 48 ounces of LiNO<sub>3</sub> solution added per 100 pounds of portland cement. CaO content of the fly ash shall not exceed 15 percent.

### **Precast Concrete**

The SCM content in precast portland cement concrete shall conform to one of the following:

- A. Any combination of portland cement and SCM, satisfying the following equation:

Equation (3)

$$\frac{(25 \times UF) + (12 \times FA) + (10 \times FB) + (6 \times SL)}{TC} \geq X$$

Where:

UF = Silica fume, metakaolin, or UFFA, including the amount in blended cement, pounds per cubic yard.

FA = Fly ash or natural pozzolan conforming to the requirements in AASHTO Designation: M 295, Class F or N with a CaO content up to 10 percent, including the amount in blended cement, pounds per cubic yard.

FB = Fly ash or natural pozzolan conforming to the requirements in AASHTO Designation: M 295, Class F or N with a CaO content greater than 10 percent and up to 15 percent, including the amount in blended cement, pounds per cubic yard.

SL = GGBFS, including the amount in blended cement, pounds per cubic yard.

TC = Total amount of cementitious material used in the mix, pounds per cubic yard.

X = 0.0 if precast members are constructed with portland cement concrete using aggregate that is "innocuous" in conformance with the provisions in Section 90-2.02, "Aggregates."

X = 3.0 for all other aggregate.

- B. 15 percent of Class F fly ash with at least 48 ounces of LiNO<sub>3</sub> solution added per 100 pounds of portland cement. CaO content of the fly ash shall not exceed 15 percent.
- C. Any combination of supplementary cementitious material and portland cement may be used if the expansion of cementitious material and aggregate does not exceed 0.10 percent when tested in conformance with the requirements in ASTM C 1567. Test data shall be submitted with each mix design. Test data accepted by the Engineer no more than 3 years prior to the first working day of this contract will be acceptable for this entire contract, provided the data was for the same concrete mix and the same materials and material sources to be used on this contract.

### **90-2.02 AGGREGATES**

To be considered innocuous, aggregate must be on the Department's approved list, "Innocuous Aggregates for use in Concrete." Information regarding aggregate qualification and placement on the Department's approved list can be obtained at the Transportation Laboratory.

Both coarse and fine aggregate must be on the approved list for the aggregate used in concrete to be considered innocuous.

Aggregates shall be free from deleterious coatings, clay balls, roots, bark, sticks, rags, and other extraneous material.

The Contractor shall provide safe and suitable facilities, including necessary splitting devices for obtaining samples of aggregates, in conformance with California Test 125.

Aggregates shall be of such character that it will be possible to produce workable concrete within the limits of water content provided in Section 90-6.06, "Amount of Water and Penetration."

Aggregates shall have not more than 10 percent loss when tested for soundness in conformance with the requirements in California Test 214. The soundness requirement for fine aggregate will be waived, provided that the durability index, D<sub>f</sub>, of the fine aggregate is 60 or greater when tested for durability in conformance with California Test 229.

If the results of any one or more of the Cleanness Value, Sand Equivalent, or aggregate grading tests do not meet the requirements specified for "Operating Range" but all meet the "Contract Compliance" requirements, the placement of

concrete shall be suspended at the completion of the current pour until tests or other information indicate that the next material to be used in the work will comply with the requirements specified for "Operating Range."

If the results of either or both the Cleanness Value and coarse aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete that is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State \$3.50 per cubic yard for paving concrete and \$5.50 per cubic yard for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.

If the results of either or both the Sand Equivalent and fine aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete which is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State \$3.50 per cubic yard for paving concrete and \$5.50 per cubic yard for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.

The 2 preceding paragraphs apply individually to the "Contract Compliance" requirements for coarse aggregate and fine aggregate. When both coarse aggregate and fine aggregate do not conform to the "Contract Compliance" requirements, both paragraphs shall apply. The payments specified in those paragraphs are in addition to any payments made in conformance with the provisions in Section 90-1.01, "Description."

No single Cleanness Value, Sand Equivalent, or aggregate grading test shall represent more than 300 cubic yards of concrete or one day's pour, whichever is smaller.

When the source of an aggregate is changed, the Contractor shall adjust the mix proportions and submit in writing to the Engineer a copy of the mix design before using the aggregates.

**90-2.02A Coarse Aggregate**

Coarse aggregate shall consist of gravel, crushed gravel, crushed rock, reclaimed aggregate, crushed air-cooled iron blast furnace slag or combinations thereof. Crushed air-cooled blast furnace slag shall not be used in reinforced or prestressed concrete.

Reclaimed aggregate is aggregate that has been recovered from plastic concrete by washing away the cementitious material. Reclaimed aggregate shall conform to all aggregate requirements.

Coarse aggregate shall conform to the following quality requirements:

Tests	California Test	Requirements
Loss in Los Angeles Rattler (after 500 revolutions)	211	45% max.
Cleanness Value		
Operating Range	227	75 min.
Contract Compliance	227	71 min.

In lieu of the above Cleanness Value requirements, a Cleanness Value "Operating Range" limit of 71, minimum, and a Cleanness Value "Contract Compliance" limit of 68, minimum, will be used to determine the acceptability of the coarse aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Section 6-1.07, "Certificates of Compliance," certifying that:

- A. Coarse aggregate sampled at the completion of processing at the aggregate production plant had a Cleanness Value of not less than 82 when tested in conformance with the requirements in California Test 227; and
- B. Prequalification tests performed in conformance with the requirements in California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

**90-2.02B Fine Aggregate**

Fine aggregate shall consist of natural sand, manufactured sand produced from larger aggregate or a combination thereof. Manufactured sand shall be well graded.

Fine aggregate shall conform to the following quality requirements:

Test	California Test	Requirements
Organic Impurities	213	Satisfactory <sup>a</sup>
Sand Equivalent:		
Operating Range	217	75, min.
Contract Compliance	217	71, min.

<sup>a</sup> Fine aggregate developing a color darker than the reference standard color may be accepted if 95% relative mortar strength is achieved when tested in conformance with ASTM C87.

In lieu of the above Sand Equivalent requirements, a Sand Equivalent "Operating Range" limit of 71, minimum, and a Sand Equivalent "Contract Compliance" limit of 68, minimum, will be used to determine the acceptability of the fine aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Section 6-1.07, "Certificates of Compliance," certifying that:

- A. Fine aggregate sampled at the completion of processing at the aggregate production plant had a Sand Equivalent value of not less than 82 when tested by California Test 217; and
- B. Prequalification tests performed in conformance with California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

### 90-2.03 WATER

In conventionally reinforced concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 1,000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1,300 parts per million of sulfates as SO<sub>4</sub>, when tested in conformance with California Test 417. In prestressed concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 650 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1,300 parts per million of sulfates as SO<sub>4</sub>, when tested in conformance with California Test 417. In no case shall the water contain an amount of impurities that will cause either of the following results when compared to the same test using distilled or deionized water: 1) a change in the setting time of cement of more than 25 percent when tested in conformance with the requirements in ASTM Designation: C 191 or ASTM Designation: C 266 or 2) a reduction in the compressive strength of mortar at 14 days of more than 5 percent, when tested in conformance with the requirements in ASTM Designation: C 109.

In nonreinforced concrete work, the water for curing, for washing aggregates and for mixing shall be free from oil and shall not contain more than 2,000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, or more than 1,500 parts per million of sulfates as SO<sub>4</sub>, when tested in conformance with California Test 417.

In addition to the above provisions, water for curing concrete shall not contain impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

Water reclaimed from mixer wash-out operations may be used in mixing concrete. The water shall not contain coloring agents or more than 300 parts per million of alkalis (Na<sub>2</sub>O + 0.658 K<sub>2</sub>O) as determined on the filtrate. The specific gravity of the water shall not exceed 1.03 and shall not vary more than ±0.010 during a day's operations.

### 90-2.04 Admixture Materials

Admixture materials shall be stored and dispensed in liquid form and conform to the following requirements:

- A. Chemical Admixtures—ASTM Designation: C 494.
- B. Air-entraining Admixtures—ASTM Designation: C 260.
- C. Lithium Nitrate shall be in an aqueous solution conforming to the following:
  1. Lithium Nitrate (LiNO<sub>3</sub>) must be 30 percent +/- 0.5 percent by weight
  2. Sulfate (SO<sub>4</sub>) must be less than 1000 ppm
  3. Chloride (Cl) must be less than 1000 ppm
  4. Alkalis (Na<sub>2</sub>O + 0.658 K<sub>2</sub>O) must be less than 1000 ppm

## 90-3 AGGREGATE GRADINGS

### 90-3.01 GENERAL

Before beginning concrete work, the Contractor shall submit in writing to the Engineer the gradation of the primary aggregate nominal sizes that the Contractor proposes to furnish. If a primary coarse aggregate or the fine aggregate is

separated into 2 or more sizes, the proposed gradation shall consist of the gradation for each individual size, and the proposed proportions of each individual size, combined mathematically to indicate one proposed gradation. The proposed gradation shall meet the grading requirements shown in the table in this section, and shall show the percentage passing each of the sieve sizes used in determining the end result.

The Engineer may waive, in writing, the gradation requirements in this Section 90-3.01 and in Sections 90-3.02, "Coarse Aggregate Grading," 90-3.03, "Fine Aggregate Grading," and 90-3.04, "Combined Aggregate Gradings," if, in the Engineer's opinion, furnishing the gradation is not necessary for the type or amount of concrete work to be constructed.

Gradations proposed by the Contractor shall be within the following percentage passing limits:

Primary Aggregate Nominal Size	Sieve Size	Limits of Proposed Gradation
1-1/2" x 3/4"	1"	19 - 41
1" x No. 4	3/4"	52 - 85
1" x No. 4	3/8"	15 - 38
1/2" x No. 4	3/8"	40 - 78
3/8" x No. 8	3/8"	50 - 85
Fine Aggregate	No. 16	55 - 75
Fine Aggregate	No. 30	34 - 46
Fine Aggregate	No. 50	16 - 29

Should the Contractor change the source of supply, the Contractor shall submit in writing to the Engineer the new gradations before their intended use.

### 90-3.02 COARSE AGGREGATE GRADING

The grading requirements for coarse aggregates are shown in the following table for each size of coarse aggregate:

Sieve Sizes	Percentage Passing Primary Aggregate Nominal Sizes							
	1-1/2" x 3/4"		1" x No. 4		1/2" x No. 4		3/8" x No. 8	
	Operating Range	Contract Compliance	Operating Range	Contract Compliance	Operating Range	Contract Compliance	Operating Range	Contract Compliance
2"	100	100	—	—	—	—	—	—
1-1/2"	88 - 100	85 - 100	100	100	—	—	—	—
1"	X ±18	X ±25	88 - 100	86 - 100	—	—	—	—
3/4"	0 - 17	0 - 20	X ±15	X ±22	100	100	—	—
1/2"	—	—	—	—	82 - 100	80 - 100	100	100
3/8"	0 - 7	0 - 9	X ±15	X ±22	X ±15	X ±22	X ±15	X ±20
No. 4	—	—	0 - 16	0 - 18	0 - 15	0 - 18	0 - 25	0 - 28
No. 8	—	—	0 - 6	0 - 7	0 - 6	0 - 7	0 - 6	0 - 7

In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

Coarse aggregate for the 1-1/2 inch, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," shall be furnished in 2 or more primary aggregate nominal sizes. Each primary aggregate nominal size may be separated into 2 sizes and stored separately, provided that the combined material conforms to the grading requirements for that particular primary aggregate nominal size.

When the one inch, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," is to be used, the coarse aggregate may be separated into 2 sizes and stored separately, provided that the combined material shall conform to the grading requirements for the 1" x No. 4 primary aggregate nominal size.

### 90-3.03 FINE AGGREGATE GRADING

Fine aggregate shall be graded within the following limits:

Sieve Sizes	Percentage Passing	
	Operating Range	Contract Compliance
3/8"	100	100
No. 4	95 - 100	93 - 100
No. 8	65 - 95	61 - 99
No. 16	X ±10	X ±13
No. 30	X ±9	X ±12
No. 50	X ±6	X ±9
No. 100	2 - 12	1 - 15
No. 200	0 - 8	0 - 10

In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

In addition to the above required grading analysis, the distribution of the fine aggregate sizes shall be such that the difference between the total percentage passing the No. 16 sieve and the total percentage passing the No. 30 sieve shall be between 10 and 40, and the difference between the percentage passing the No. 30 and No. 50 sieves shall be between 10 and 40.

Fine aggregate may be separated into 2 or more sizes and stored separately, provided that the combined material conforms to the grading requirements specified in this Section 90-3.03.

#### 90-3.04 COMBINED AGGREGATE GRADINGS

Combined aggregate grading limits shall be used only for the design of concrete mixes. Concrete mixes shall be designed so that aggregates are combined in proportions that shall produce a mixture within the grading limits for combined aggregates as specified herein.

The combined aggregate grading, except when otherwise specified in these specifications or the special provisions, shall be either the 1-1/2 inch, maximum grading, or the 1 inch, maximum grading, at the option of the Contractor.

Grading Limits of Combined Aggregates

Sieve Sizes	Percentage Passing			
	1-1/2" Max.	1" Max.	1/2" Max.	3/8" Max.
2"	100	—	—	—
1-1/2"	90 - 100	100	—	—
1"	50 - 86	90 - 100	—	—
3/4"	45 - 75	55 - 100	100	—
1/2"	—	—	90 - 100	100
3/8"	38 - 55	45 - 75	55 - 86	50 - 100
No. 4	30 - 45	35 - 60	45 - 63	45 - 63
No. 8	23 - 38	27 - 45	35 - 49	35 - 49
No. 16	17 - 33	20 - 35	25 - 37	25 - 37
No. 30	10 - 22	12 - 25	15 - 25	15 - 25
No. 50	4 - 10	5 - 15	5 - 15	5 - 15
No. 100	1 - 6	1 - 8	1 - 8	1 - 8
No. 200	0 - 3	0 - 4	0 - 4	0 - 4

Changes from one grading to another shall not be made during the progress of the work unless permitted by the Engineer.

#### 90-4 ADMIXTURES

##### 90-4.01 GENERAL

Admixtures used in portland cement concrete shall conform to and be used in conformance with the provisions in this Section 90-4 and the special provisions. Admixtures shall be used when specified or ordered by the Engineer and may be used at the Contractor's option as provided herein.

Chemical admixtures and air-entraining admixtures containing chlorides as Cl in excess of one percent by weight of admixture, as determined by California Test 415, shall not be used.

Admixtures shall be uniform in properties throughout their use in the work. Should it be found that an admixture as furnished is not uniform in properties, its use shall be discontinued.

If more than one admixture is used, the admixtures shall be compatible with each other so that the desirable effects of all admixtures used will be realized.

Chemical admixtures shall be used in conformance with the manufacturer's written recommendations. The manufacturer's written recommendations shall include a statement that the admixtures are compatible with the types and amounts of SCMs used.

#### **90-4.02 MATERIALS**

Admixture materials shall conform to the provisions in Section 90-2.04, "Admixture Materials."

#### **90-4.03 ADMIXTURE APPROVAL**

No admixture brand shall be used in the work unless it is on the Department's current list of approved brands for the type of admixture involved. Information regarding admixture qualification and placement on the Department's list can be obtained at the Transportation Laboratory.

If the Contractor proposes to use an admixture of a brand and type on the current list of approved admixture brands, the Contractor shall furnish a Certificate of Compliance from the manufacturer, as provided in Section 6-1.07, "Certificates of Compliance," certifying that the admixture furnished is the same as that previously approved. If a previously approved admixture is not accompanied by a Certificate of Compliance, the admixture shall not be used in the work until the Engineer has had sufficient time to make the appropriate tests and has approved the admixture for use. The Engineer may take samples for testing at any time, whether or not the admixture has been accompanied by a Certificate of Compliance.

#### **90-4.04 REQUIRED USE OF CHEMICAL ADMIXTURES**

If the use of a chemical admixture is specified, the admixture shall be used at the dosage specified, except that if no dosage is specified, the admixture shall be used at the dosage normally recommended by the manufacturer of the admixture.

#### **90-4.05 OPTIONAL USE OF CHEMICAL ADMIXTURES**

The Contractor may use Type A or F, water-reducing; Type B, retarding; or Type D or G, water-reducing and retarding admixtures as described in ASTM Designation: C 494 to conserve cementitious material or to facilitate any concrete construction application subject to the following conditions:

- A. If a water-reducing admixture or a water-reducing and retarding admixture is used, the cementitious material content specified or ordered may be reduced by a maximum of 5 percent by weight, except that the resultant cementitious material content shall be not less than 505 pounds per cubic yard; and
- B. When a reduction in cementitious material content is made, the dosage of admixture used shall be no less than the dosage used in determining approval of the admixture.

The Contractor may use Type S admixtures conforming to the requirements in ASTM Designation: C 494.

Unless otherwise specified, a Type C accelerating chemical admixture conforming to the requirements in ASTM Designation: C 494, may be used in portland cement concrete. Inclusion in the mix design submitted for approval will not be required provided that the admixture is added to counteract changing conditions that contribute to delayed setting of the portland cement concrete, and the use or change in dosage of the admixture is approved in writing by the Engineer.

#### **90-4.06 REQUIRED USE OF AIR-ENTRAINING ADMIXTURES**

When air-entrainment is specified or ordered by the Engineer, the air-entraining admixture shall be used in amounts to produce a concrete having the specified air content as determined by California Test 504.

#### **90-4.07 OPTIONAL USE OF AIR-ENTRAINING ADMIXTURES**

When air-entrainment has not been specified or ordered by the Engineer, the Contractor will be permitted to use an air-entraining admixture to facilitate the use of any construction procedure or equipment provided that the average air content, as determined by California Test 504, of 3 successive tests does not exceed 4 percent, and no single test value exceeds 5.5 percent. If the Contractor elects to use an air-entraining admixture in concrete for pavement, the Contractor shall so indicate at the time the Contractor designates the source of aggregate.

#### **90-4.08 BLANK**

#### **90-4.09 BLANK**

#### **90-4.10 PROPORTIONING AND DISPENSING LIQUID ADMIXTURES**

Chemical admixtures and air-entraining admixtures shall be dispensed in liquid form. Dispensers for liquid admixtures shall have sufficient capacity to measure at one time the prescribed quantity required for each batch of concrete. Each dispenser shall include a graduated measuring unit into which liquid admixtures are measured to within  $\pm 5$  percent of the prescribed quantity for each batch. Dispensers shall be located and maintained so that the graduations can be accurately read from the point at which proportioning operations are controlled to permit a visual check of batching accuracy prior to discharge. Each measuring unit shall be clearly marked for the type and quantity of admixture.

Each liquid admixture dispensing system shall be equipped with a sampling device consisting of a valve located in a safe and readily accessible position such that a sample of the admixture may be withdrawn slowly by the Engineer.

If more than one liquid admixture is used in the concrete mix, each liquid admixture shall have a separate measuring unit and shall be dispensed by injecting equipment located in such a manner that the admixtures are not mixed at high concentrations and do not interfere with the effectiveness of each other. When air-entraining admixtures are used in conjunction with other liquid admixtures, the air-entraining admixture shall be the first to be incorporated into the mix, unless it is demonstrated that a different sequence improves performance.

When automatic proportioning devices are used, dispensers for liquid admixtures shall operate automatically with the batching control equipment. The dispensers shall be equipped with an automatic warning system in good operating condition that will provide a visible or audible signal at the point at which proportioning operations are controlled when the quantity of admixture measured for each batch of concrete varies from the preselected dosage by more than 5 percent, or when the entire contents of the measuring unit are not emptied from the dispenser into each batch of concrete.

Unless liquid admixtures are added to premeasured water for the batch, their discharge into the batch shall be arranged to flow into the stream of water so that the admixtures are well dispersed throughout the batch, except that air-entraining admixtures may be dispensed directly into moist sand in the batching bins provided that adequate control of the air content of the concrete can be maintained.

Liquid admixtures requiring dosages greater than one-half gallon per cubic yard shall be considered to be water when determining the total amount of free water as specified in Section 90-6.06, "Amount of Water and Penetration."

#### **90-4.11 BLANK**

### **90-5 PROPORTIONING**

#### **90-5.01 STORAGE OF AGGREGATES**

Aggregates shall be stored or stockpiled in such a manner that separation of coarse and fine particles of each size shall be avoided and the various sizes shall not become intermixed before proportioning.

Aggregates shall be stored or stockpiled and handled in a manner that prevent contamination by foreign materials. In addition, storage of aggregates at batching or mixing facilities that are erected subsequent to the award of the contract and that furnish concrete to the project shall conform to the following:

- A. Intermingling of the different sizes of aggregates shall be positively prevented. The Contractor shall take the necessary measures to prevent intermingling. The preventive measures may include, but are not necessarily limited to, physical separation of stockpiles or construction of bulkheads of adequate length and height; and
- B. Contamination of aggregates by contact with the ground shall be positively prevented. The Contractor shall take the necessary measures to prevent contamination. The preventive measures shall include, but are not necessarily limited to, placing aggregates on wooden platforms or on hardened surfaces consisting of portland cement concrete, asphalt concrete, or cement treated material.

In placing aggregates in storage or in moving the aggregates from storage to the weigh hopper of the batching plant, any method that may cause segregation, degradation, or the combining of materials of different gradings that will result in any size of aggregate at the weigh hopper failing to meet the grading requirements, shall be discontinued. Any method of handling aggregates that results in excessive breakage of particles shall be discontinued. The use of suitable devices to reduce impact of falling aggregates may be required by the Engineer.

#### **90-5.02 PROPORTIONING DEVICES**

Weighing, measuring, or metering devices used for proportioning materials shall conform to the requirements in Section 9-1.01, "Measurement of Quantities," and this Section 90-5.02. In addition, automatic weighing systems shall comply with the requirements for automatic proportioning devices in Section 90-5.03A, "Automatic Proportioning." Automatic devices shall be automatic to the extent that the only manual operation required for proportioning the aggregates, cement, and SCM for one batch of concrete is a single operation of a switch or starter.

For concrete pavement, aggregate and bulk cementitious material must be proportioned by weight by means of automatic proportioning devices.

Proportioning devices shall be tested as frequently as the Engineer may deem necessary to ensure their accuracy.

Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the plant is in operation, the weight of each batch of material shall not vary from the weight designated by the Engineer by more than the tolerances specified herein.

Equipment for cumulative weighing of aggregate shall have a zero tolerance of  $\pm 0.5$  percent of the designated total batch weight of the aggregate. For systems with individual weigh hoppers for the various sizes of aggregate, the zero tolerance shall be  $\pm 0.5$  percent of the individual batch weight designated for each size of aggregate. Equipment for cumulative weighing of cement and SCM shall have a zero tolerance of  $\pm 0.5$  percent of the designated total batch weight of the cement and SCM. Equipment for weighing cement or SCM separately shall have a zero tolerance of  $\pm 0.5$  percent of their designated individual batch weights. Equipment for measuring water shall have a zero tolerance of  $\pm 0.5$  percent of its designated weight or volume.

The weight indicated for any batch of material shall not vary from the preselected scale setting by more than the following:

- A. Aggregate weighed cumulatively shall be within 1.0 percent of the designated total batch weight of the aggregate. Aggregates weighed individually shall be within 1.5 percent of their respective designated batch weights; and
- B. Cement shall be 99 to 102 percent of its designated batch weight. When weighed individually, SCM shall be 99 to 102 percent of its designated batch weight. When SCM and cement are permitted to be weighed cumulatively, cement shall be weighed first to 99 to 102 percent of its designated batch weight, and the total for cement and SCM shall be 99 to 102 percent of the sum of their designated batch weights. When a blended cement is used, the percentages of cement and SCM used for calculating batch weights shall be based on the percentage of SCM indicated in the Certificate of Compliance from the blended cement supplier; and
- C. Water shall be within 1.5 percent of its designated weight or volume.

Each scale graduation shall be approximately 0.001 of the total capacity of the scale. The capacity of scales for weighing cement, SCM, or cement plus SCM and aggregates shall not exceed that of commercially available scales having single graduations indicating a weight not exceeding the maximum permissible weight variation above, except that no scale shall be required having a capacity of less than 1,000 pounds, with one pound graduations.

### **90-5.03 PROPORTIONING**

Proportioning shall consist of dividing the aggregates into the specified sizes, each stored in a separate bin, and combining them with cementitious material and water as provided in these specifications. Aggregates shall be proportioned by weight.

At the time of batching, aggregates shall have been dried or drained sufficiently to result in a stable moisture content such that no visible separation of water from aggregate will take place during transportation from the proportioning plant to the point of mixing. In no event shall the free moisture content of the fine aggregate at the time of batching exceed 8 percent of its saturated, surface-dry weight.

Should separate supplies of aggregate material of the same size group, but of different moisture content or specific gravity or surface characteristics affecting workability, be available at the proportioning plant, withdrawals shall be made from one supply exclusively and the materials therein completely exhausted before starting upon another.

Bulk Type IP (MS) or Type IS (MS) cement shall be weighed in an individual hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer.

Bulk cement and SCM may be weighed in separate, individual weigh hoppers or may be weighed in the same weigh hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer. If the cement and SCM are weighed cumulatively, the cement shall be weighed first.

If cement and SCM are weighed in separate weigh hoppers, the weigh systems for the proportioning of the aggregate, the cement, and the SCM shall be individual and distinct from all other weigh systems. Each weigh system shall be equipped with a hopper, a lever system, and an indicator to constitute an individual and independent material-weighing device. The cement and the SCM shall be discharged into the mixer simultaneously with the aggregate.

The scales and weigh hoppers for bulk weighing cement, SCM, or cement plus SCM shall be separate and distinct from the aggregate weighing equipment.

For batches of one cubic yard or more, the batching equipment shall conform to one of the following combinations:

- A. Separate boxes and separate scale and indicator for weighing each size of aggregate.
- B. Single box and scale indicator for all aggregates.
- C. Single box or separate boxes and automatic weighing mechanism for all aggregates.

In order to check the accuracy of batch weights, the gross weight and tare weight of batch trucks, truck mixers, truck agitators, and non-agitating hauling equipment shall be determined when ordered by the Engineer. The equipment shall be weighed on scales designated by the Engineer.

### **90-5.03A Automatic Proportioning**

Automatic proportioning devices shall be authorized by the Department.

For concrete pavement, the Contractor shall install and maintain in operating condition an electronically actuated moisture meter that will indicate, on a readily visible scale, changes in the moisture content of the fine aggregate as it is batched within a sensitivity of 0.5 percent by weight of the fine aggregate.

The batching of cement, SCM, or cement plus SCM and aggregate shall be interlocked so that a new batch cannot be started until all weigh hoppers are empty, the proportioning devices are within zero tolerance, and the discharge gates are closed. The interlock shall permit no part of the batch to be discharged until all aggregate hoppers and the cement and SCM hoppers or the cement plus SCM hopper are charged with weights that are within the tolerances specified in Section 90-5.02, "Proportioning Devices."

If interlocks are required for cement and SCM charging mechanisms and cement and SCM are weighed cumulatively, their charging mechanisms shall be interlocked to prevent the introduction of SCM until the weight of cement in the cement weigh hopper is within the tolerances specified in Section 90-5.02, "Proportioning Devices."

If concrete is completely mixed in stationary mixers, the SCMs shall be weighed in a separate weigh hopper and the SCM and cement shall be introduced simultaneously into the mixer proportionately with the aggregate. If the Contractor provides certification that the stationary mixer is capable of mixing the cement, SCM, aggregates, and water uniformly before discharge, weighing the SCM cumulatively with the cement is permitted. Certification shall contain the following:

- A. Test results for 2 compressive strength test cylinders of concrete taken within the first one-third and 2 compressive strength test cylinders of concrete taken within the last one-third of the concrete discharged from a single batch from the stationary mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength";
- B. Calculations demonstrating that the difference in the averages of 2 compressive strengths taken in the first one-third is no greater than 7.5 percent different than the averages of 2 compressive strengths taken in the last one-third of the concrete discharged from a single batch from the stationary mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength;" and
- C. The mixer rotation speed and time of mixing before discharge that are required to produce a mix that meets the requirements above.

The discharge gate on the cement and SCM hoppers or the cement plus SCM hopper shall be designed to permit regulating the flow of cement, SCM, or cement plus SCM into the aggregate as directed by the Engineer.

If separate weigh boxes are used for each size of aggregate, the discharge gates shall permit regulating the flow of each size of aggregate as directed by the Engineer.

Material discharged from the several bins shall be controlled by gates or by mechanical conveyors. The means of withdrawal from the several bins, and of discharge from the weigh box, shall be interlocked so that not more than one bin can discharge at a time, and so that the weigh box cannot be tripped until the required quantity from each of the several bins has been deposited therein. Should a separate weigh box be used for each size of aggregate, all may be operated and discharged simultaneously.

If the discharge from the several bins is controlled by gates, each gate shall be actuated automatically so that the required weight is discharged into the weigh box, after which the gate shall automatically close and lock.

The automatic weighing system shall be designed so that all proportions required may be set on the weighing controller at the same time.

## **90-6 MIXING AND TRANSPORTING**

### **90-6.01 GENERAL**

Concrete shall be mixed in mechanically operated mixers, except that when permitted by the Engineer, batches not exceeding 1/3 cubic yard may be mixed by hand methods in conformance with the provisions in Section 90-6.05, "Hand-Mixing."

Equipment having components made of aluminum or magnesium alloys that would have contact with plastic concrete during mixing, transporting, or pumping of portland cement concrete shall not be used.

Concrete shall be homogeneous and thoroughly mixed, and there shall be no lumps or evidence of undispersed cementitious material.

Uniformity of concrete mixtures will be determined by differences in penetration as determined by California Test 533, or slump as determined by ASTM Designation: C 143, and by variations in the proportion of coarse aggregate as determined by California Test 529.

When the mix design specifies a penetration value, the difference in penetration, determined by comparing penetration tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed 1/2 inch. When the mix design specifies a slump value, the difference in slump, determined by comparing slump tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed the values given in the table below. Variation in the proportion of coarse aggregate will be determined by comparing the results of tests of 2 samples of mixed concrete from the same batch or truck mixer load and the difference between the 2 results shall not exceed 170 pounds per cubic yard of concrete.

Average Slump	Maximum Permissible Difference
Less than 4"	1"
4" to 6"	1-1/2"
Greater than 6" to 9"	2"

The Contractor shall furnish samples of the freshly mixed concrete and provide satisfactory facilities for obtaining the samples.

**90-6.02 MACHINE MIXING**

Concrete mixers may be of the revolving drum or the revolving blade type, and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer. Mixers and agitators that have an accumulation of hard concrete or mortar shall not be used.

The temperature of mixed concrete, immediately before placing, shall be not less than 50 °F or more than 90 °F. Aggregates and water shall be heated or cooled as necessary to produce concrete within these temperature limits. Neither aggregates nor mixing water shall be heated to exceed 150 °F. If ice is used to cool the concrete, discharge of the mixer will not be permitted until all ice is melted.

The batch shall be so charged into the mixer that some water will enter in advance of cementitious materials and aggregates. All water shall be in the drum by the end of the first one-fourth of the specified mixing time. When concrete is delivered in a truck mixer, a portion of the mixing water may be withheld and, if allowed by the Engineer, may be added at the point of delivery as specified under Section 90-6.03, "Transporting Mixed Concrete."

Cementitious materials shall be batched and charged into the mixer by means that will not result either in loss of cementitious materials due to the effect of wind, in accumulation of cementitious materials on surfaces of conveyors or hoppers, or in other conditions that reduce or vary the required quantity of cementitious material in the concrete mixture.

Stationary mixers shall be operated with an automatic timing device. The timing device and discharge mechanism shall be interlocked so that during normal operation no part of the batch will be discharged until the specified mixing time has elapsed.

The total elapsed time between the intermingling of damp aggregates and all cementitious materials and the start of mixing shall not exceed 30 minutes.

The size of batch shall not exceed the manufacturer's guaranteed capacity.

When producing concrete for pavement or base, suitable batch counters shall be installed and maintained in good operating condition at job site batching plants and stationary mixers. The batch counters shall indicate the exact number of batches proportioned and mixed.

Concrete shall be mixed and delivered to the job site by means of one of the following combinations of operations:

- A. Mixed completely in a stationary mixer and the mixed concrete transported to the point of delivery in truck agitators or in nonagitating hauling equipment (central-mixed concrete).
- B. Mixed partially in a stationary mixer, and the mixing completed in a truck mixer (shrink-mixed concrete).
- C. Mixed completely in a truck mixer (transit-mixed concrete).

Agitators may be truck mixers operating at agitating speed or truck agitators. Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of the volume of mixed concrete and the speed of rotation of the mixing drum or blades.

Truck mixers shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may readily be verified.

When shrink-mixed concrete is furnished, concrete that has been partially mixed at a central plant shall be transferred to a truck mixer and all requirements for transit-mixed concrete shall apply. No credit in the number of revolutions at mixing speed will be allowed for partial mixing in a central plant.

### **90-6.03 TRANSPORTING MIXED CONCRETE**

Mixed concrete may be transported to the delivery point in truck agitators or truck mixers operating at the speed designated by the manufacturer of the equipment as agitating speed, or in non-agitating hauling equipment, provided the consistency and workability of the mixed concrete upon discharge at the delivery point is suitable for adequate placement and consolidation in place, and provided the mixed concrete after hauling to the delivery point conforms to the provisions in Section 90-6.01, "General."

Truck agitators shall be loaded not to exceed the manufacturer's guaranteed capacity and shall maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.

Bodies of nonagitating hauling equipment shall be constructed so that leakage of the concrete mix, or any part thereof, will not occur at any time.

Concrete hauled in open-top vehicles shall be protected during hauling against rain or against exposure to the sun for more than 20 minutes when the ambient temperature exceeds 75 °F.

No water in excess of that in the approved mix design shall be incorporated into the concrete. If approved by the Engineer, water withheld during batching may be added to the concrete at the delivery point in one operation before the discharge of more than 1/4 cubic yard. Equipment for supplying the water shall conform to Section 90-6.06, "Amount of Water and Penetration." When water is added at the point of delivery, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharge is commenced.

The rate of discharge of mixed concrete from a truck mixer or agitator shall be controlled by the speed of rotation of the drum in the discharge direction with the discharge gate fully open.

If a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be completed within 1.5 hours or before 250 revolutions of the drum or blades, whichever occurs first, after the introduction of the cementitious materials to the aggregates. Under conditions contributing to quick stiffening of the concrete, or if the temperature of the concrete is 85 °F or above, the time allowed may be less than 1.5 hours. If an admixture is used to retard the set time, the temperature of the concrete shall not exceed 85 °F, the time limit shall be 2 hours, and the revolution limitation shall be 300.

If nonagitating hauling equipment is used for transporting concrete to the delivery point, discharge shall be completed within one hour after the addition of the cementitious materials to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85 °F or above, the time between the introduction of cementitious materials to the aggregates and discharge shall not exceed 45 minutes.

Each load of concrete delivered at the job site shall be accompanied by a weighmaster certificate showing the mix identification number, nonrepeating load number, date and time at which the materials were batched, the total amount of water added to the load, and for transit-mixed concrete, the reading of the revolution counter at the time the truck mixer is charged with cement. This weighmaster certificate shall also show the actual scale weights (pounds) for the ingredients batched. Theoretical or target batch weights shall not be used as a substitute for actual scale weights.

Weighmaster certificates shall be provided in printed form, or if approved by the Engineer, the data may be submitted in electronic media. Electronic media shall be presented in a tab-delimited format on a CD or DVD. Captured data, for the ingredients represented by each batch shall be "line feed, carriage return" (LFCR) and "one line, separate record" with allowances for sufficient fields to satisfy the amount of data required by these specifications.

The Contractor may furnish a weighmaster certificate accompanied by a separate certificate that lists the actual batch weights or measurements for a load of concrete provided that both certificates are imprinted with the same nonrepeating load number that is unique to the contract and delivered to the jobsite with the load.

Weighmaster certificates furnished by the Contractor shall conform to the provisions in Section 9-1.01, "Measurement of Quantities."

### **90-6.04 TIME OR AMOUNT OF MIXING**

Mixing of concrete in stationary mixers shall continue for the required mixing time after all ingredients, except water and admixture, if added with the water, are in the mixing compartment of the mixer before any part of the batch is released. Transfer time in multiple drum mixers shall not be counted as part of the required mixing time.

The required mixing time, in stationary mixers, of concrete used for concrete structures, except minor structures, shall be not less than 90 seconds or more than 5 minutes, except that when directed by the Engineer in writing, the requirements of the following paragraph shall apply.

The required mixing time in stationary mixers, except as provided in the preceding paragraph, shall be not less than 50 seconds or more than 5 minutes.

The minimum required revolutions at the mixing speed for transit-mixed concrete shall not be less than that recommended by the mixer manufacturer, but in no case shall the number of revolutions be less than that required to consistently produce concrete conforming to the provisions for uniformity in Section 90-6.01, "General."

When a high range water-reducing admixture is added to the concrete at the job site, the total number of revolutions shall not exceed 300.

### 90-6.05 HAND-MIXING

Hand-mixed concrete shall be made in batches of not more than 1/3 cubic yard and shall be mixed on a watertight, level platform. The proper amount of coarse aggregate shall be measured in measuring boxes and spread on the platform and the fine aggregate shall be spread on this layer, the 2 layers being not more than one foot in total depth. On this mixture shall be spread the dry cementitious materials and the whole mass turned no fewer than 2 times dry; then sufficient clean water shall be added, evenly distributed, and the whole mass again turned no fewer than 3 times, not including placing in the carriers or forms.

### 90-6.06 AMOUNT OF WATER AND PENETRATION

The amount of water used in concrete mixes shall be regulated so that the penetration of the concrete as determined by California Test 533 or the slump of the concrete as determined by ASTM Designation: C 143 is within the nominal values shown in the following table. When the penetration or slump of the concrete is found to exceed the nominal values listed, the mixture of subsequent batches shall be adjusted to reduce the penetration or slump to a value within the nominal range shown. Batches of concrete with a penetration or slump exceeding the maximum values listed shall not be used in the work. If Type F or Type G chemical admixtures are added to the mix, the penetration requirements shall not apply and the slump shall not exceed 9 inches after the chemical admixtures are added.

Type of Work	Nominal		Maximum	
	Penetration (inches)	Slump (inches)	Penetration (inches)	Slump (inches)
Concrete Pavement	0 - 1	—	1-1/2	—
Non-reinforced concrete facilities	0 - 1-1/2	—	2	—
Reinforced concrete structures				
Sections over 12 inches thick	0 - 1-1/2	—	2-1/2	—
Sections 12 inches thick or less	0 - 2	—	3	—
Concrete placed under water	—	6 - 8	—	9
Cast-in-place concrete piles	2-1/2 - 3-1/2	5 - 7	4	8

The amount of free water used in concrete shall not exceed 310 pounds per cubic yard, plus 20 pounds for each required 100 pounds of cementitious material in excess of 550 pounds per cubic yard.

The term free water is defined as the total water in the mixture minus the water absorbed by the aggregates in reaching a saturated surface-dry condition.

If there are adverse or difficult conditions that affect the placing of concrete, the above specified penetration and free water content limitations may be exceeded providing the Contractor is granted permission by the Engineer in writing to increase the cementitious material content per cubic yard of concrete. The increase in water and cementitious material shall be at a ratio not to exceed 30 pounds of water per added 100 pounds of cementitious material per cubic yard. Full compensation for additional cementitious material and water added under these conditions shall be considered as included in the contract price paid for the concrete work involved and no additional compensation will be allowed therefor.

The equipment for supplying water to the mixer shall be constructed and arranged so that the amount of water added can be measured accurately. Any method of discharging water into the mixer for a batch shall be accurate within 1.5 percent of the quantity of water required to be added to the mix for any position of the mixer. Tanks used to measure water shall be designed so that water cannot enter while water is being discharged into the mixer and discharge into the mixer shall be made rapidly in one operation without dribbling. All equipment shall be arranged so as to permit checking the amount of water delivered by discharging into measured containers.

## 90-7 CURING CONCRETE

### 90-7.01 METHODS OF CURING

Newly placed concrete shall be cured by the methods specified in this Section 90-7.01 and the special provisions.

#### 90-7.01A Water Method

The concrete shall be kept continuously wet by the application of water for a minimum curing period of 7 days after the concrete has been placed.

Cotton mats, rugs, carpets, or earth or sand blankets may be used as a curing medium to retain the moisture during the curing period.

If a curing medium consisting of cotton mats, rugs, carpets, polyethylene sheeting, polyethylene sheeting on burlap, or earth or sand blankets is to be used to retain the moisture, the entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed, until the surface of the concrete is covered

with the curing medium. The moisture from the nozzle shall not be applied under pressure directly upon the concrete and shall not be allowed to accumulate on the concrete in a quantity sufficient to cause a flow or wash the surface. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing media.

At the option of the Contractor, a curing medium consisting of white opaque polyethylene sheeting extruded onto burlap may be used to cure concrete structures. The polyethylene sheeting shall have a minimum thickness of 4-mil, and shall be extruded onto 10-ounce burlap.

At the option of the Contractor, a curing medium consisting of polyethylene sheeting may be used to cure concrete columns. The polyethylene sheeting shall have a minimum thickness of 10-mil achieved in a single layer of material.

If the Contractor chooses to use polyethylene sheeting or polyethylene sheeting on burlap as a curing medium, these media and any joints therein shall be secured as necessary to provide moisture retention and shall be within 3 inches of the concrete at all points along the surface being cured. When these media are used, the temperature of the concrete shall be monitored during curing. If the temperature of the concrete cannot be maintained below 140° F, use of these curing media shall be disallowed.

When concrete bridge decks and flat slabs are to be cured without the use of a curing medium, the entire surface of the bridge deck or slab shall be kept damp by the application of water with an atomizing nozzle as specified above, until the concrete has set, after which the entire surface of the concrete shall be sprinkled continuously with water for a period of not less than 7 days.

### **90-7.01B Curing Compound Method**

Surfaces of the concrete that are exposed to the air shall be sprayed uniformly with a curing compound.

Curing compounds to be used shall be as follows:

1. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B, except the resin type shall be poly-alpha-methylstyrene.
2. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B.
3. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class A.
4. Nonpigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class B.
5. Nonpigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class A.
6. Nonpigmented curing compound with fugitive dye conforming to the requirements in ASTM Designation: C 309, Type 1-D, Class A.

The infrared scan for the dried vehicle from curing compound (1) shall match the infrared scan on file at the Transportation Laboratory.

The loss of water for each type of curing compound, when tested in conformance with the requirements in California Test 534, shall not be more than 0.28 pounds per square yard in 24 hours.

The curing compound to be used will be specified elsewhere in these specifications or in the special provisions.

If the use of curing compound is required or permitted elsewhere in these specifications or in the special provisions and no specific kind is specified, any of the curing compounds listed above may be used.

Curing compound shall be applied at a nominal rate of one gallon per 150 square feet, unless otherwise specified.

At any point, the application rate shall be within  $\pm 50$  square feet per gallon of the nominal rate specified, and the average application rate shall be within  $\pm 25$  square feet per gallon of the nominal rate specified when tested in conformance with the requirements in California Test 535. Runs, sags, thin areas, skips, or holidays in the applied curing compound shall be evidence that the application is not satisfactory.

Curing compounds shall be applied using power operated spray equipment. The power operated spraying equipment shall be equipped with an operational pressure gage and a means of controlling the pressure. Hand spraying of small and irregular areas that are not reasonably accessible to mechanical spraying equipment, in the opinion of the Engineer, may be permitted.

The curing compound shall be applied to the concrete following the surface finishing operation, immediately before the moisture sheen disappears from the surface, but before any drying shrinkage or craze cracks begin to appear. In the event of any drying or cracking of the surface, application of water with an atomizing nozzle as specified in Section 90-7.01A, "Water Method," shall be started immediately and shall be continued until application of the compound is resumed or started; however, the compound shall not be applied over any resulting freestanding water. Should the film of compound be damaged from any cause before the expiration of 7 days after the concrete is placed in the case of structures and 72 hours in the case of pavement, the damaged portion shall be repaired immediately with additional compound.

At the time of use, compounds containing pigments shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. A paddle shall be used to loosen all settled pigment from the bottom of the container, and a power driven agitator shall be used to disperse the pigment uniformly throughout the vehicle.

Agitation shall not introduce air or other foreign substance into the curing compound.

The manufacturer shall include in the curing compound the necessary additives for control of sagging, pigment settling, leveling, de-emulsification, or other requisite qualities of a satisfactory working material. Pigmented curing compounds shall be manufactured so that the pigment does not settle badly, does not cake or thicken in the container, and does not become granular or curdled. Settlement of pigment shall be a thoroughly wetted, soft, mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with minimum resistance to the sideways manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency.

Curing compounds shall remain sprayable at temperatures above 40 °F and shall not be diluted or altered after manufacture.

The curing compound shall be packaged in clean 274-gallon totes, 55-gallon barrels or 5-gallon pails shall be supplied from a suitable storage tank located at the jobsite. The containers shall comply with "Title 49, Code of Federal Regulations, Hazardous Materials Regulations." The 274-gallon totes and the 55-gallon barrels shall have removable lids and airtight fasteners. The 5-gallon pails shall be round and have standard full open head and bail. Lids with bungholes will not be permitted. Settling or separation of solids in containers, except tanks, must be completely redispersed with low speed mixing prior to use, in conformance with these specifications and the manufacturer's recommendations. Mixing shall be accomplished either manually by use of a paddle or by use of a mixing blade driven by a drill motor, at low speed. Mixing blades shall be the type used for mixing paint. On-site storage tanks shall be kept clean and free of contaminants. Each tank shall have a permanent system designed to completely redisperse settled material without introducing air or other foreign substances.

Steel containers and lids shall be lined with a coating that will prevent destructive action by the compound or chemical agents in the air space above the compound. The coating shall not come off the container or lid as skins. Containers shall be filled in a manner that will prevent skinning. Plastic containers shall not react with the compound.

Each container shall be labeled with the manufacturer's name, kind of curing compound, batch number, volume, date of manufacture, and volatile organic compound (VOC) content. The label shall also warn that the curing compound containing pigment shall be well stirred before use. Precautions concerning the handling and the application of curing compound shall be shown on the label of the curing compound containers in conformance with the Construction Safety Orders and General Industry Safety Orders of the State.

Containers of curing compound shall be labeled to indicate that the contents fully comply with the rules and regulations concerning air pollution control in the State.

When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall accompany each load. The invoice shall contain the same information as that required herein for container labels.

Curing compound will be sampled by the Engineer at the source of supply, at the job site, or at both locations.

Curing compound shall be formulated so as to maintain the specified properties for a minimum of one year. The Engineer may require additional testing before use to determine compliance with these specifications if the compound has not been used within one year or whenever the Engineer has reason to believe the compound is no longer satisfactory.

Tests will be conducted in conformance with the latest ASTM test methods and methods in use by the Transportation Laboratory.

#### **90-7.01C Waterproof Membrane Method**

The exposed finished surfaces of concrete shall be sprayed with water, using a nozzle that so atomizes the flow that a mist and not a spray is formed, until the concrete has set, after which the curing membrane, shall be placed. The curing membrane shall remain in place for a period of not less than 72 hours.

Sheeting material for curing concrete shall conform to the requirements in AASHTO Designation: M 171 for white reflective materials.

The sheeting material shall be fabricated into sheets of such width as to provide a complete cover for the entire concrete surface. Joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint. The joint seams shall have a minimum lap of 0.33 foot.

The sheets shall be securely weighted down by placing a bank of earth on the edges of the sheets or by other means satisfactory to the Engineer.

Should any portion of the sheets be broken or damaged before the expiration of 72 hours after being placed, the broken or damaged portions shall be immediately repaired with new sheets properly cemented into place.

Sections of membrane that have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing the concrete shall not be used.

#### **90-7.01D Forms-In-Place Method**

Formed surfaces of concrete may be cured by retaining the forms in place. The forms shall remain in place for a minimum period of 7 days after the concrete has been placed, except that for members over 20 inches in least dimension the forms shall remain in place for a minimum period of 5 days.

Joints in the forms and the joints between the end of forms and concrete shall be kept moisture tight during the curing period. Cracks in the forms and cracks between the forms and the concrete shall be resealed by methods subject to the approval of the Engineer.

## **90-7.02 BLANK**

## **90-7.03 CURING STRUCTURES**

Newly placed concrete for cast-in-place structures, other than highway bridge decks, shall be cured by the water method, the forms-in-place method, or, as permitted herein, by the curing compound method, in conformance with the provisions in Section 90-7.01, "Methods of Curing."

The curing compound method using a pigmented curing compound may be used on concrete surfaces of construction joints, surfaces that are to be buried underground, and surfaces where only ordinary surface finish is to be applied and on which a uniform color is not required and that will not be visible from a public traveled way. If the Contractor elects to use the curing compound method on the bottom slab of box girder spans, the curing compound shall be curing compound (1).

The top surface of highway bridge decks shall be cured by both the curing compound method and the water method. The curing compound shall be curing compound (1).

Concrete surfaces of minor structures, as defined in Section 51-1.02, "Minor Structures," shall be cured by the water method, the forms-in-place method or the curing compound method.

When deemed necessary by the Engineer during periods of hot weather, water shall be applied to concrete surfaces being cured by the curing compound method or by the forms-in-place method, until the Engineer determines that a cooling effect is no longer required. Application of water for this purpose will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."

## **90-7.04 CURING PRECAST CONCRETE MEMBERS**

Precast concrete members shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing." Curing shall be provided for the minimum time specified for each method or until the concrete reaches its design strength, whichever is less. Steam curing may also be used for precast members and shall conform to the following provisions:

- A. After placement of the concrete, members shall be held for a minimum 4-hour presteaming period. If the ambient air temperature is below 50 °F, steam shall be applied during the presteaming period to hold the air surrounding the member at a temperature between 50 °F and 90 °F.
- B. To prevent moisture loss on exposed surfaces during the presteaming period, members shall be covered as soon as possible after casting or the exposed surfaces shall be kept wet by fog spray or wet blankets.
- C. Enclosures for steam curing shall allow free circulation of steam about the member and shall be constructed to contain the live steam with a minimum moisture loss. The use of tarpaulins or similar flexible covers will be permitted, provided they are kept in good repair and secured in such a manner as to prevent the loss of steam and moisture.
- D. Steam at the jets shall be at low pressure and in a saturated condition. Steam jets shall not impinge directly on the concrete, test cylinders, or forms. During application of the steam, the temperature rise within the enclosure shall not exceed 40 °F per hour. The curing temperature throughout the enclosure shall not exceed 150 °F and shall be maintained at a constant level for a sufficient time necessary to develop the required transfer strength. Control cylinders shall be covered to prevent moisture loss and shall be placed in a location where temperature is representative of the average temperature of the enclosure.
- E. Temperature recording devices that will provide an accurate, continuous, permanent record of the curing temperature shall be provided. A minimum of one temperature recording device per 200 feet of continuous bed length will be required for checking temperature.
- F. Members in pretension beds shall be detensioned immediately after the termination of steam curing while the concrete and forms are still warm, or the temperature under the enclosure shall be maintained above 60 °F until the stress is transferred to the concrete.
- G. Curing of precast concrete will be considered completed after termination of the steam curing cycle.

## **90-7.05 CURING PRECAST PRESTRESSED CONCRETE PILES**

Newly placed concrete for precast prestressed concrete piles shall be cured in conformance with the provisions in Section 90-7.04, "Curing Precast Concrete Members," except that piles in a corrosive environment shall be cured as follows:

- A. Piles shall be either steam cured or water cured. If water curing is used, the piles shall be kept continuously wet by the application of water in conformance with the provisions in Section 90-7.01A, "Water Method."

- B. If steam curing is used, the steam curing provisions in Section 90-7.04, "Curing Precast Concrete Members," shall apply except that the piles shall be kept continuously wet for their entire length for a period of not less than 3 days, including the holding and steam curing periods.

#### **90-7.06 CURING SLOPE PROTECTION**

Concrete slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."

Concreted-rock slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing," with a blanket of earth kept wet for 72 hours, or by sprinkling with a fine spray of water every 2 hours during the daytime for a period of 3 days.

#### **90-7.07 CURING MISCELLANEOUS CONCRETE WORK**

Exposed surfaces of curbs shall be cured by pigmented curing compounds as specified in Section 90-7.01B, "Curing Compound Method."

Concrete sidewalks, gutter depressions, island paving, curb ramps, driveways, and other miscellaneous concrete areas shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."

Shotcrete shall be cured for at least 72 hours by spraying with water, by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

Mortar and grout shall be cured by keeping the surface damp for 3 days.

After placing, the exposed surfaces of sign structure foundations, including pedestal portions, if constructed, shall be cured for at least 72 hours by spraying with water, by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

### **90-8 PROTECTING CONCRETE**

#### **90-8.01 GENERAL**

In addition to the provisions in Section 7-1.16, "Contractor's Responsibility for the Work and Materials," the Contractor shall protect concrete as provided in this Section 90-8. If required by the Engineer, the Contractor shall submit a written outline of the proposed methods for protecting the concrete.

The Contractor shall protect concrete from damage from any cause, which shall include, but not be limited to: rain, heat, cold, wind, Contractor's actions, and actions of others.

Concrete shall not be placed on frozen or ice-coated ground or subgrade nor on ice-coated forms, reinforcing steel, structural steel, conduits, precast members, or construction joints.

Under rainy conditions, placing of concrete shall be stopped before the quantity of surface water is sufficient to damage surface mortar or cause a flow or wash of the concrete surface, unless the Contractor provides adequate protection against damage.

Concrete that has been frozen or damaged by other causes, as determined by the Engineer, shall be removed and replaced by the Contractor at the Contractor's expense.

#### **90-8.02 PROTECTING CONCRETE STRUCTURES**

Structure concrete and shotcrete used as structure concrete shall be maintained at a temperature of not less than 45 °F for 72 hours after placing and at not less than 40 °F for an additional 4 days.

### **90-9 COMPRESSIVE STRENGTH**

#### **90-9.01 GENERAL**

Concrete compressive strength requirements consist of a minimum strength that shall be attained before various loads or stresses are applied to the concrete and, for concrete designated by compressive strength, a minimum strength at the age of 28 days or at the age otherwise allowed in Section 90-1.01, "Description." The various strengths required are specified in these specifications or the special provisions or are shown on the plans.

The compressive strength of concrete will be determined from test cylinders that have been fabricated from concrete sampled in conformance with the requirements of California Test 539. Test cylinders will be molded and initially field cured in conformance with California Test 540. Test cylinders will be cured and tested after receipt at the testing laboratory in conformance with the requirements of California Test 521. A strength test shall consist of the average strength of 2 cylinders fabricated from material taken from a single load of concrete, except that, if any cylinder should show evidence of improper sampling, molding, or testing, that cylinder shall be discarded and the strength test shall consist of the strength of the remaining cylinder.

When concrete compressive strength is specified as a prerequisite to applying loads or stresses to a concrete structure or member, test cylinders for other than steam cured concrete will be cured in conformance with Method 1 of California Test 540. The compressive strength of concrete determined for these purposes will be evaluated on the basis of individual tests.

When concrete is designated by compressive strength rather than by cementitious material content, the concrete strength to be used as a basis for acceptance of other than steam cured concrete will be determined from cylinders cured in conformance with Method 1 of California Test 540. If the result of a single compressive strength test at the maximum age specified or allowed is below the specified strength but is 95 percent or more of the specified strength, the Contractor shall make corrective changes, subject to approval of the Engineer, in the mix proportions or in the concrete fabrication procedures, before placing additional concrete, and shall pay to the State \$10 for each in-place cubic yard of concrete represented by the deficient test. If the result of a single compressive strength test at the maximum age specified or allowed is below 95 percent of the specified strength, but is 85 percent or more of the specified strength, the Contractor shall make the corrective changes specified above, and shall pay to the State \$15 for each in-place cubic yard of concrete represented by the deficient test. In addition, such corrective changes shall be made when the compressive strength of concrete tested at 7 days indicates, in the judgment of the Engineer, that the concrete will not attain the required compressive strength at the maximum age specified or allowed. Concrete represented by a single test that indicates a compressive strength of less than 85 percent of the specified 28-day compressive strength will be rejected in conformance with the provisions in Section 6-1.04, "Defective Materials."

If the test result indicates that the compressive strength at the maximum age specified or allowed is below the specified strength, but is 85 percent or more of the specified strength, payments to the State as required above shall be made, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength of the concrete placed in the work meets or exceeds the specified 28-day compressive strength. If the test result indicates a compressive strength at the maximum age specified or allowed below 85 percent, the concrete represented by that test will be rejected, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength of the concrete placed in the work is at least 85 percent of the specified strength. If the evidence consists of tests made on cores taken from the work, the cores shall be obtained and tested in conformance with the requirements in ASTM Designation: C 42.

No single compressive strength test shall represent more than 320 cubic yards.

If a precast concrete member is steam cured, the compressive strength of the concrete will be determined from test cylinders that have been handled and stored in conformance with Method 3 of California Test 540. The compressive strength of steam cured concrete will be evaluated on the basis of individual tests representing specific portions of production. If the concrete is designated by 28-day compressive strength rather than by cementitious material content, the concrete shall be considered to be acceptable whenever its compressive strength reaches the specified 28-day compressive strength provided that strength is reached in not more than the maximum number of days specified or allowed after the member is cast.

When concrete has a specified 28-day compressive strength greater than 3,600 pounds per square inch or when prequalification is specified, prequalification of materials, mix proportions, mixing equipment, and procedures proposed for use will be required prior to placement of the concrete. Prequalification shall be accomplished by the submission of acceptable certified test data or trial batch reports by the Contractor. Prequalification data shall be based on the use of materials, mix proportions, mixing equipment, procedures, and size of batch proposed for use in the work.

Certified test data, in order to be acceptable, shall indicate that not less than 90 percent of at least 20 consecutive tests exceed the specified strength at the maximum number of days specified or allowed, and none of those tests are less than 95 percent of specified strength. Strength tests included in the data shall be the most recent tests made on concrete of the proposed mix design and all shall have been made within one year of the proposed use of the concrete.

Trial batch test reports, in order to be acceptable, shall indicate that the average compressive strength of 5 consecutive concrete cylinders, taken from a single batch, at not more than 28 days (or the maximum age allowed) after molding shall be at least 600 pounds per square inch greater than the specified 28-day compressive strength, and no individual cylinder shall have a strength less than the specified strength at the maximum age specified or allowed. Data contained in the report shall be from trial batches that were produced within one year of the proposed use of specified strength concrete in the project. Whenever air-entrainment is required, the air content of trial batches shall be equal to or greater than the air content specified for the concrete without reduction due to tolerances.

Tests shall be performed in conformance with either the appropriate California Test methods or the comparable ASTM test methods. Equipment employed in testing shall be in good condition and shall be properly calibrated. If the tests are performed during the life of the contract, the Engineer shall be notified sufficiently in advance of performing the tests in order to witness the test procedures.

The certified test data and trial batch test reports shall include the following information:

- A. Date of mixing.
- B. Mixing equipment and procedures used.
- C. The size of batch in cubic yards and the weight, type, and source of all ingredients used.

- D. Penetration or slump (if the concrete will be placed under water or placed in cast-in-place concrete piles) of the concrete.
- E. The air content of the concrete if an air-entraining admixture is used.
- F. The age at time of testing and strength of all concrete cylinders tested.

Certified test data and trial batch test reports shall be signed by an official of the firm that performed the tests.

When approved by the Engineer, concrete from trial batches may be used in the work at locations where concrete of a lower quality is required and the concrete will be paid for as the type of concrete required at that location.

After materials, mix proportions, mixing equipment, and procedures for concrete have been prequalified for use, additional prequalification by testing of trial batches will be required prior to making changes that, in the judgment of the Engineer, could result in a strength of concrete below that specified.

The Contractor's attention is directed to the time required to test trial batches and the Contractor shall be responsible for production of trial batches at a sufficiently early date so that the progress of the work is not delayed.

When precast concrete members are manufactured at the plant of an established manufacturer of precast concrete members, the mix proportions of the concrete shall be determined by the Contractor, and a trial batch and prequalification of the materials, mix proportions, mixing equipment, and procedures will not be required.

## 90-10 MINOR CONCRETE

### 90-10.01 GENERAL

Concrete for minor structures, slope paving, curbs, sidewalks and other concrete work, when designated as minor concrete on the plans, in the specifications, or in the contract item, shall conform to the provisions specified herein.

The Engineer, at the Engineer's discretion, will inspect and test the facilities, materials and methods for producing the concrete to ensure that minor concrete of the quality suitable for use in the work is obtained.

Before using minor concrete or in advance of revising the mix proportions, the Contractor shall submit in writing to the Engineer a copy of the mix design. When required by the following table, the Contractor shall include compressive strength test results verifying the minimum specified compressive strength:

SCM	Test Submittal Required
Fly Ash used alone	When portland cement content < 350 lbs/cy
GGBFS used alone	When portland cement content < 250 lbs/cy
Natural Pozzolan used alone	When portland cement content < 350 lbs/cy
More than 1 SCM	Always

Tests shall be performed by an ACI certified technician.

### 90-10.02 MATERIALS

Minor concrete shall conform to the following requirements:

#### 90-10.02A Cementitious Material

Cementitious material shall conform to the provisions in Section 90-1.01, "Description," and 90-2, "Materials."

#### 90-10.02B Aggregate

Aggregate shall be clean and free from deleterious coatings, clay balls, roots, and other extraneous materials.

Use of crushed concrete or reclaimed aggregate is acceptable only if the aggregate satisfies all aggregate requirements.

The Contractor shall submit to the Engineer for approval, a grading of the combined aggregate proposed for use in the minor concrete. After acceptance of the grading, aggregate furnished for minor concrete shall conform to that grading, unless a change is authorized in writing by the Engineer.

The Engineer may require the Contractor to furnish periodic test reports of the aggregate grading furnished. The maximum size of aggregate used shall be at the option of the Contractor, but in no case shall the maximum size be larger than 1-1/2-inch or smaller than 3/4 inch.

The Engineer may waive, in writing, the gradation requirements in this Section 90-10.02B, if, in the Engineer's opinion, the furnishing of the gradation is not necessary for the type or amount of concrete work to be constructed.

#### 90-10.02C Water

Water used for washing, mixing, and curing shall be free from oil, salts, and other impurities that would discolor or etch the surface or have an adverse affect on the quality of the concrete.

### **90-10.02D Admixtures**

The use of admixtures shall conform to the provisions in Section 90-4, "Admixtures."

### **90-10.03 PRODUCTION**

Cementitious material, water, aggregate, and admixtures shall be stored, proportioned, mixed, transported, and discharged in conformance with recognized standards of good practice that will result in concrete that is thoroughly and uniformly mixed, that is suitable for the use intended, and that conforms to requirements specified herein. Recognized standards of good practice are outlined in various industry publications such as are issued by American Concrete Institute, AASHTO, or the Department.

The cementitious material content of minor concrete shall conform to the provisions in Section 90-1.01, "Description."

The amount of water used shall result in a consistency of concrete conforming to the provisions in Section 90-6.06, "Amount of Water and Penetration." Additional mixing water shall not be incorporated into the concrete during hauling or after arrival at the delivery point, unless allowed by the Engineer.

Discharge of ready-mixed concrete from the transporting vehicle shall be made while the concrete is still plastic and before stiffening occurs. An elapsed time of 1.5 hours (one hour in non-agitating hauling equipment), or more than 250 revolutions of the drum or blades, after the introduction of the cementitious material to the aggregates, or a temperature of concrete of more than 90 °F will be considered conditions contributing to the quick stiffening of concrete. The Contractor shall take whatever action is necessary to eliminate quick stiffening, except that the addition of water will not be permitted.

The required mixing time in stationary mixers shall be not less than 50 seconds or more than 5 minutes.

The minimum required revolutions at mixing speed for transit-mixed concrete shall be not less than that recommended by the mixer manufacturer, and shall be increased, if necessary, to produce thoroughly and uniformly mixed concrete.

When a high range water-reducing admixture is added to the concrete at the job site, the total number of revolutions shall not exceed 300.

Each load of ready-mixed concrete shall be accompanied by a weighmaster certificate that shall be delivered to the Engineer at the discharge location of the concrete, unless otherwise directed by the Engineer. The weighmaster certificate shall be clearly marked with the date and time of day when the load left the batching plant and, if hauled in truck mixers or agitators, the time the mixing cycle started.

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall be furnished to the Engineer, prior to placing minor concrete from a source not previously used on the contract, stating that minor concrete to be furnished meets contract requirements, including minimum cementitious material content specified.

### **90-10.04 CURING MINOR CONCRETE**

Curing minor concrete shall conform to the provisions in Section 90-7, "Curing Concrete."

### **90-10.05 PROTECTING MINOR CONCRETE**

Protecting minor concrete shall conform to the provisions in Section 90-8, "Protecting Concrete," except the concrete shall be maintained at a temperature of not less than 40 °F for 72 hours after placing.

### **90-10.06 MEASUREMENT AND PAYMENT**

Minor concrete will be measured and paid for in conformance with the provisions specified in the various sections of these specifications covering concrete construction when minor concrete is specified in the specifications, shown on the plans, or indicated by contract item in the Engineer's Estimate.

## **90-11 MEASUREMENT AND PAYMENT**

### **90-11.01 MEASUREMENT**

Portland cement concrete will be measured in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

For concrete measured at the mixer, the volume in cubic feet shall be computed as the total weight of the batch in pounds divided by the density of the concrete in pounds per cubic foot. The total weight of the batch shall be calculated as the sum of all materials, including water, entering the batch. The density of the concrete will be determined in conformance with the requirements in California Test 518.

### **90-11.02 PAYMENT**

Portland cement concrete will be paid for in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.





Performance Graded Asphalt Binder

Property	AASHTO Test Method	Specification				
		Grade				
		PG 58-22 <sup>a</sup>	PG 64-10	PG 64-16	PG 64-28	PG 70-10
Original Binder						
Flash Point, Minimum °C	T 48	230	230	230	230	230
Solubility, Minimum % <sup>b</sup>	T 44	99	99	99	99	99
Viscosity at 135°C, <sup>c</sup> Maximum, Pa·s	T 316	3.0	3.0	3.0	3.0	3.0
Dynamic Shear, Test Temp. at 10 rad/s, °C Minimum G*/sin(delta), kPa	T 315	58 1.00	64 1.00	64 1.00	64 1.00	70 1.00
RTFO Test, <sup>e</sup> Mass Loss, Maximum, %	T 240	1.00	1.00	1.00	1.00	1.00
RTFO Test Aged Binder						
Dynamic Shear, Test Temp. at 10 rad/s, °C Minimum G*/sin(delta), kPa	T 315	58 2.20	64 2.20	64 2.20	64 2.20	70 2.20
Ductility at 25°C Minimum, cm	T 51	75	75	75	75	75
PAV <sup>f</sup> Aging, Temperature, °C	R 28	100	100	100	100	110
RTFO Test and PAV Aged Binder						
Dynamic Shear, Test Temp. at 10 rad/s, °C Maximum G*/sin(delta), kPa	T 315	22 <sup>d</sup> 5000	31 <sup>d</sup> 5000	28 <sup>d</sup> 5000	22 <sup>d</sup> 5000	34 <sup>d</sup> 5000
Creep Stiffness, Test Temperature, °C Maximum S-value, Mpa Minimum M-value	T 313	-12 300 0.300	0 300 0.300	-6 300 0.300	-18 300 0.300	0 300 0.300

Notes:

- a. Use as asphalt rubber base stock for high mountain and high desert area.
- b. The Engineer waives this specification if the supplier is a Quality Supplier as defined by the Department's "Certification Program for Suppliers of Asphalt."
- c. The Engineer waives this specification if the supplier certifies the asphalt binder can be adequately pumped and mixed at temperatures meeting applicable safety standards.
- d. Test the sample at 3°C higher if it fails at the specified test temperature. G\*/sin(delta) remains 5000 kPa maximum.
- e. "RTFO Test" means the asphaltic residue obtained using the Rolling Thin Film Oven Test, AASHTO Test Method T 240 or ASTM Designation: D 2872. The residue from mass change determination may be used for other tests.
- f. "PAV" means Pressurized Aging Vessel.

Performance graded polymer modified asphalt binder (PG Polymer Modified) is:

Performance Graded Polymer Modified Asphalt Binder <sup>a</sup>

Property	AASHTO Test Method	Specification Grade		
		PG 58-34 PM	PG 64-28 PM	PG 76-22 PM
<b>Original Binder</b>				
Flash Point, Minimum °C	T 48	230	230	230
Solubility, Minimum % <sup>b</sup>	T 44 <sup>c</sup>	98.5	98.5	98.5
Viscosity at 135°C, <sup>d</sup> Maximum, Pa·s	T 316	3.0	3.0	3.0
Dynamic Shear, Test Temp. at 10 rad/s, °C Minimum G*/sin(delta), kPa	T 315	58 1.00	64 1.00	76 1.00
RTFO Test , Mass Loss, Maximum, %	T 240	1.00	1.00	1.00
<b>RTFO Test Aged Binder</b>				
Dynamic Shear, Test Temp. at 10 rad/s, °C Minimum G*/sin(delta), kPa	T 315	58 2.20	64 2.20	76 2.20
Dynamic Shear, Test Temp. at 10 rad/s, °C Maximum (delta), %	T 315	Note e 80	Note e 80	Note e 80
Elastic Recovery <sup>f</sup> , Test Temp., °C Minimum recovery, %	T 301	25 75	25 75	25 65
PAV <sup>g</sup> Aging, Temperature, °C	R 28	100	100	110
<b>RTFO Test and PAV Aged Binder</b>				
Dynamic Shear, Test Temp. at 10 rad/s, °C Maximum G*/sin(delta), kPa	T 315	16 5000	22 5000	31 5000
Creep Stiffness, Test Temperature, °C Maximum S-value, MPa Minimum M-value	T 313	-24 300 0.300	-18 300 0.300	-12 300 0.300

Notes:

- a. Do not modify PG Polymer Modified using acid modification.
- b. The Engineer waives this specification if the supplier is a Quality Supplier as defined by the Department's "Certification Program for Suppliers of Asphalt."
- c. The Department allows ASTM D 5546 instead of AASHTO T 44
- d. The Engineer waives this specification if the supplier certifies the asphalt binder can be adequately pumped and mixed at temperatures meeting applicable safety standards.
- e. Test temperature is the temperature at which G\*/sin(delta) is 2.2 kPa. A graph of log G\*/sin(delta) plotted against temperature may be used to determine the test temperature when G\*/sin(delta) is 2.2 kPa. A graph of (delta) versus temperature may be used to determine delta at the temperature when G\*/sin(delta) is 2.2 kPa. The Engineer also accepts direct measurement of (delta) at the temperature when G\*/sin(delta) is 2.2 kPa.
- f. Tests without a force ductility clamp may be performed.
- g. "PAV" means Pressurized Aging Vessel.

**SAMPLING**

Provide a sampling device in the asphalt feed line connecting the plant storage tanks to the asphalt weighing system or spray bar. Make the sampling device accessible between 24 and 30 inches above the platform. Provide a receptacle for flushing the sampling device.

Include with the sampling device a valve:

1. Between 1/2 and 3/4 inch in diameter



**Characteristics of Adhesive:**

Test <sup>a</sup>	California Test	Requirement
Brookfield Viscosity, No. 3 Spindle at 20 rpm, Poise at 77°F	434, Part 4	0.9 max.
Gel time, minutes	434, Part 1	2 to 15
Slant Shear Strength on Dry Concrete, psi, after 4 days of cure in air at 77° F ±2° F	434, Part 5 <sup>b</sup>	3,000 min.
Slant Shear Strength on Wet Concrete, psi, after 4 days of cure in air at 77° F ±2° F	434, Part 5 <sup>b</sup>	1,700 min.
Tensile Strength, psi	434, Part 7, except test after 4 days of cure at 77° F ±2° F	4,500 min.
Elongation, %	434, Part 7, except test after 4 days of cure at 77° F ±2° F	10 max.

<sup>a</sup> The mixing ratio used will be that recommended by the manufacturer.

<sup>b</sup> For slant shear strength on concrete, delete Sections B-1 and B-5 of California Test 434, Part 5. For dry concrete, use Step "2" below only. For wet concrete, use both Steps "1" & "2":

1. Soak blocks in water for 24 hours at 77° F ±2° F. Remove and wipe off excess water.
2. Mix epoxy as described in California Test 434, Part 1, and apply a coat approximately 0.010-inch thick to each diagonal surface. Place four 0.125-inch square pieces of shim stock 0.012-inch thick on one block to control final film thickness. Before pressing the coated surfaces together, leave the blocks so that the coated surfaces are horizontal until the epoxy reacts slightly to prevent excessive flow.