



STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

**NOTICE TO BIDDERS
AND
SPECIAL PROVISIONS**

**FOR CONSTRUCTION ON STATE HIGHWAY IN SAN DIEGO COUNTY NEAR
BONSALL AND FALLBROOK ON ROUTE 15 FROM 0.3 MILE SOUTH TO 0.3
MILE NORTH OF ROUTE 76/15 SEPARATION AND ON ROUTE 76 FROM 0.4
MILE WEST OF SOUTH MISSION ROAD TO 0.5 MILE EAST OF ROUTE 76/15
SEPARATION**

In District 11 On Route 15,76

Under

Bid book dated April 28, 2014

Standard Specifications dated 2010

Project plans approved March 24, 2014

Standard Plans dated 2010

Identified by

Contract No. 11-257154

11-SD-15,76-R46.2/R46.8, R12.1/R17.7

Project ID 1100020489

Federal-Aid Project

STPL-6211(114)E

TPF-2012(001)E

**Bids open Thursday, June 19, 2014
Dated April 28, 2014**

**XS
AADD
OSD
IH**

SPECIAL NOTICES

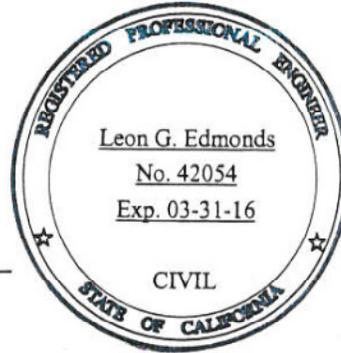
- For federal-aid projects, the Department is modifying its DBE program.
- See Section 2-1.04 for scheduled outreach meeting.

CONTRACT NO. 11-257154

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

HIGHWAY

Leon G. Edmonds
REGISTERED CIVIL ENGINEER



ELECTRICAL (HIGHWAY)

Dante C. Buenviaje
REGISTERED CIVIL ENGINEER



LANDSCAPE

Tom Browne
LICENSED LANDSCAPE ARCHITECT

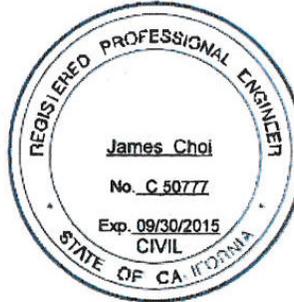


CONTRACT NO. 11-257154

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

STRUCTURES


REGISTERED CIVIL ENGINEER



DESIGN OVERSIGHT APPROVAL	REGISTRATION NO.	DATE
PRINTED NAME	SIGNATURE	
Simon S. Lee		C66401
DD		06-30-14

Approved as to impact on State facilities and conformance with applicable State standards and practices as described in the A & E Consultant Services Manual.

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

UTILITY


REGISTERED CIVIL ENGINEER



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STANDARD PLANS LIST

The standard plan sheets applicable to this Contract include those listed below. The applicable revised standard plans (RSPs) listed below are included in the project plans.

A10A	Abbreviations (Sheet 1 of 2)
RSP A10B	Abbreviations (Sheet 2 of 2)
A10C	Lines and Symbols (Sheet 1 of 3)
A10D	Lines and Symbols (Sheet 2 of 3)
A10E	Lines and Symbols (Sheet 3 of 3)
A10F	Legend - Soil (Sheet 1 of 2)
A10G	Legend - Soil (Sheet 2 of 2)
A10H	Legend - Rock
A20A	Pavement Markers and Traffic Lines, Typical Details
A20B	Pavement Markers and Traffic Lines, Typical Details
A20D	Pavement Markers and Traffic Lines, Typical Details
RSP A24A	Pavement Markings - Arrows
A24B	Pavement Markings - Arrows and Symbols
RSP A24C	Pavement Markings - Symbols and Numerals
A24D	Pavement Markings - Words
RSP A24E	Pavement Markings - Words, Limit and Yield Lines
RSP A24F	Pavement Markings - Crosswalks
A62A	Excavation and Backfill - Miscellaneous Details
A62B	Limits of Payment for Excavation and Backfill - Bridge Surcharge and Wall
A62C	Limits of Payment for Excavation and Backfill - Bridge
A62D	Excavation and Backfill - Concrete Pipe Culverts
A62DA	Excavation and Backfill - Concrete Pipe Culverts - Indirect Design Method
A62E	Excavation and Backfill - Cast-In-Place Reinforced Concrete Box and Arch Culverts
A62F	Excavation and Backfill - Metal and Plastic Culverts
A73A	Object Markers
A73B	Markers
A73C	Delineators, Channelizers and Barricades
A76A	Concrete Barrier Type 60
A76B	Concrete Barrier Type 60
A76K	Concrete Barrier - Wildlife Passageway (Type M)

RSP A77L2	Midwest Guardrail System Standard Railing Section (Steel Post with Notched Wood or Notched Recycled Plastic Block)
RSP A77M1	Midwest Guardrail System Standard Hardware
RSP A77N2	Midwest Guardrail System Steel Post and Notched Wood Block Details
RSP A77N3	Midwest Guardrail System Typical Line Post Embedment and Hinge Point Offset Details
RSP A77N4	Midwest Guardrail System Typical Railing Delineation and Dike Positioning Details
RSP A77Q1	Midwest Guardrail System Typical Layouts for Structure Approach
RSP A77U1	Midwest Guardrail System Connections to Bridge Railings without Sidewalks Details No. 1
RSP A77U2	Midwest Guardrail System Connections to Bridge Railings without Sidewalks Details No. 2
RSP A77U3	Midwest Guardrail System Connections to Abutments and Walls
RSP A77U4	Midwest Guardrail System Transition Railing (Type WB-31)
A85	Chain Link Fence
A85A	Chain Link Fence Details
RSP A85B	Chain Link Fence Details
RSP A87A	Curbs and Driveways
RSP A87B	Hot Mix Asphalt Dikes
RSP A88A	Curb Ramp Details
RSP A90A	Accessible Parking Off-Street
RSP P4	Continuously Reinforced Concrete Pavement
RSP P14	Continuously Reinforced Concrete Pavement Transverse Construction Joint
RSP P16	Continuously Reinforced Concrete Pavement Tie Bars and Joint Details
RSP P31A	Continuously Reinforced Concrete Pavement Terminal Joint Details
RSP P31B	Continuously Reinforced Concrete Pavement - Expansion Joint and Anchor Details
P45	Concrete Pavement - Drainage Inlet Details No. 1
RSP P74	Pavement Edge Treatments
RSP P75	Pavement Edge Treatments - Overlays
RSP P76	Pavement Edge Treatments - New Construction
D71	Drainage Inlet Markers
D72	Drainage Inlets
RSP D73	Drainage Inlets
D73A	Drainage Inlets (Precast)
D74A	Drainage Inlets
D74B	Drainage Inlets
D74C	Drainage Inlet Details
D75A	Steel Pipe Inlets

D75B	Concrete Pipe Inlets
D75C	Pipe Inlets - Ladder and Trash Rack Details
RSP D77A	Grate Details No. 1
RSP D77B	Grate Details No. 2
D77C	Alternative Hinged Cover for Type OL and OS Inlets and Trash Rack for Type OCP Inlet
D78A	Gutter Depressions
D78C	Inlet Depressions - Hot Mix Asphalt Shoulders
D79	Precast Reinforced Concrete Pipe - Direct Design Method
D79A	Precast Reinforced Concrete Pipe - Direct Design Method
D80	Cast-In-Place Reinforced Concrete - Single Box Culvert
D81	Cast-In-Place Reinforced Concrete - Double Box Culvert
D82	Cast-In-Place Reinforced Concrete Box Culvert - Miscellaneous Details
D84	Box Culvert Wingwalls - Types A, B and C
D87D	Overside Drains
D88	Construction Loads on Culverts
D89	Pipe Culvert Headwalls - Straight and "L"
D90	Pipe Culvert Headwalls, Endwalls and Wingwalls - Types A, B and C
D91A	Cast-In-Place Reinforced Concrete - Junction Structure
D91B	Cast-In-Place Reinforced Concrete - Junction Structure
D93A	Pipe Riser Connections
D93B	Drainage Inlet Riser Connections
D93C	Pipe Riser with Debris Rack Cage
D94A	Metal and Plastic Flared End Sections
D94B	Concrete Flared End Sections
D97A	Corrugated Metal Pipe Coupling Details No. 1 - Annular Coupling Band Bar and Strap and Angle Connections
D97C	Corrugated Metal Pipe Coupling Details No. 3 - Helical and Universal Couplers
D97D	Corrugated Metal Pipe Coupling Details No. 4 - Hugger Coupling Bands
D97E	Corrugated Metal Pipe Coupling Details No. 5 - Standard Joint
D97F	Corrugated Metal Pipe Coupling Details No. 6 - Positive Joint
D97G	Corrugated Metal Pipe Coupling Details No. 7 - Downdrain
D97H	Reinforced Concrete Pipe or Non-Reinforced Concrete Pipe - Standard and Positive Joints
D97I	Corrugated Polyvinyl Chloride Pipe with Smooth Interior - Standard and Positive Joints
D97J	Composite Steel Spiral Rib Pipe with Smooth Interior - Standard Joint
D98C	Grated Line Drain Details

D98D	Slotted Plastic Pipe Drain Details
D100A	Gabion Basket Details No. 1
D100B	Gabion Basket Details No. 2
D102	Underdrains
RSP H1	Landscape and Erosion Control Abbreviations
RSP H2	Landscape and Erosion Control Symbols
H3	Landscape Details
RSP H4	Landscape Details
RSP H5	Landscape Details
RSP H6	Landscape Details
RSP H7	Landscape Details
RSP H9	Landscape Details
H51	Erosion Control Details - Fiber Roll and Compost Sock
H52	Rolled Erosion Control Product
T1A	Temporary Crash Cushion, Sand Filled (Unidirectional)
T1B	Temporary Crash Cushion, Sand Filled (Bidirectional)
T2	Temporary Crash Cushion, Sand Filled (Shoulder Installations)
T3A	Temporary Railing (Type K)
T3B	Temporary Railing (Type K)
RSP T9	Traffic Control System Tables for Lane and Ramp Closures
RSP T11	Traffic Control System for Lane Closure on Multilane Conventional Highways
RSP T12	Traffic Control System for Half Road Closure on Multilane Conventional Highways and Expressways
RSP T13	Traffic Control System for Lane Closure on Two Lane Conventional Highways
RSP T14	Traffic Control System for Ramp Closure
RSP T15	Traffic Control System for Moving Lane Closure on Multilane Highways
RSP T16	Traffic Control System for Moving Lane Closure on Multilane Highways
RSP T17	Traffic Control System for Moving Lane Closure on Two Lane Highways
T56	Temporary Water Pollution Control Details (Temporary Fiber Roll)
T58	Temporary Water Pollution Control Details (Temporary Construction Entrance)
T59	Temporary Water Pollution Control Details (Temporary Concrete Washout Facility)
T62	Temporary Water Pollution Control Details (Temporary Drainage Inlet Protection)
T63	Temporary Water Pollution Control Details (Temporary Drainage Inlet Protection)
T64	Temporary Water Pollution Control Details (Temporary Drainage Inlet Protection)
T65	Temporary Water Pollution Control Details [Temporary Fence (Type ESA)]

T67	Temporary Water Pollution Control Details (Temporary Construction Roadway)
B0-1	Bridge Details
B0-3	Bridge Details
B0-5	Bridge Details
B0-13	Bridge Details
RSP B3-1A	Retaining Wall Type 1 (Case 1)
RSP B3-4B	Retaining Wall Type 5 (Case 2)
RSP B3-5	Retaining Wall Details No. 1
B3-6	Retaining Wall Details No. 2
B6-21	Joint Seals (Maximum Movement Rating = 2")
B7-1	Box Girder Details
B7-10	Utility Opening - Box Girder
RSP B8-5	Cast-In-Place Post-Tensioned Girder Details
RSP B11-47	Cable Railing
B11-51	Tubular Hand Railing
B11-52	Chain Link Railing Type 7
RSP 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")
B14-5	Water Supply Line (Details) (Pipe Sizes Less Than 4")
RS1	Roadside Signs, Typical Installation Details No. 1
RS2	Roadside Signs - Wood Post, Typical Installation Details No. 2
RS4	Roadside Signs, Typical Installation Details No. 4
S89	Roadside Sign - Formed Single Sheet Aluminum 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
RSP ES-1A	Electrical Systems (Legend and Abbreviations)
RSP ES-1B	Electrical Systems (Legend and Abbreviations)
RSP ES-1C	Electrical Systems (Legend and Abbreviations)
ES-2A	Electrical Systems (Service Equipment)
ES-2C	Electrical Systems (Service Equipment Notes, Type III Series)
ES-2E	Electrical Systems (Service Equipment Enclosure and Typical Wiring Diagram, Type III - B Series)
ES-2F	Electrical Systems (Service Equipment Enclosure and Typical Wiring Diagram Type III - C Series)

ES-3C	Electrical Systems (Controller Cabinet Foundation Details)
ES-3D	Electrical Systems (Telephone Demarcation Cabinet, Type A)
ES-3H	Electrical Systems (Irrigation Controller Enclosure Cabinet)
RSP ES-4A	Electrical Systems (Vehicular Signal Heads and Mountings)
RSP ES-4B	Electrical Systems (Pedestrian Signal and Ramp Metering Sign)
RSP ES-4C	Electrical Systems (Vehicular Signal Heads and Mountings)
ES-4D	Electrical Systems (Signal Mounting)
RSP ES-4E	Electrical Systems (Vehicular Signal Heads and Optical Detector Mounting)
ES-5A	Electrical Systems (Detectors)
RSP ES-5B	Electrical Systems (Detectors)
RSP ES-5C	Electrical Systems (Accessible Pedestrian Signal, Push Button Assemblies and Magnetic Vehicle Detector)
RSP ES-5D	Electrical Systems (Curb Termination and Handhole)
ES-6A	Electrical Systems (Lighting Standard, Types 15 and 21)
ES-6D	Electrical Systems (Lighting Standard, Types 15D and 21D, Double Luminaire Mast Arm)
ES-6E	Electrical Systems (Lighting Standard, Types 30 and 31)
ES-6F	Electrical Systems (Lighting Standard, Slip Base Plate)
ES-6G	Electrical Systems (Lighting Standard, Type 32)
RSP ES-7A	Electrical Systems (Signal and Lighting Standard, Type TS, and Push Button Assembly Post)
ES-7B	Electrical Systems (Signal and Lighting Standard - Type 1 and Equipment Numbering)
RSP ES-7E	Electrical Systems (Signal and Lighting Standard, Case 3 Signal Mast Arm Loading, Wind Velocity = 100 mph and Signal Mast Arm Lengths 15' to 45')
RSP ES-7F	Electrical Systems (Signal and Lighting Standard, Case 4 Signal Mast Arm Loading, Wind Velocity = 100 mph and Signal Mast Arm Lengths 25' to 45')
RSP ES-7G	Electrical Systems (Signal And Lighting Standard, Case 5 Signal Mast Arm Loading, Wind Velocity = 100 mph and Signal Mast Arm Lengths 50' to 55')
RSP ES-7H	Electrical Systems (Signal and Lighting Standard, Case 5 Signal Mast Arm Loading, Wind Velocity = 100 mph and Signal Mast Arm Lengths 60' to 65')
RSP ES-7J	Electrical Systems (Flashing Beacon on a Type 1, Type 15-FBS and Type 40 Standard)
ES-7M	Electrical Systems (Signal and Lighting Standard - Detail No. 1)
ES-7N	Electrical Systems (Signal and Lighting Standard - Detail No. 2)
ES-7O	Electrical Systems (Signal and Lighting Standard - Detail No. 3)
ES-7P	Electrical Systems (Internally Illuminated Street Name Sign)
RSP ES-7R	Electrical Systems (Signal and Lighting, Miscellaneous Attachment)
RSP ES-8A	Electrical Systems (Non-Traffic Pull Box)
RSP ES-8B	Electrical Systems (Traffic Pull Box)
ES-9A	Electrical Systems (Structure Pull Box Installations)
ES-9B	Electrical Systems (Conduit Riser and Expansion Fitting, Structure Installations)

ES-9C	Electrical Systems (Structure Pull Box)
ES-9D	Electrical Systems (Structure Pull Box Installations)
RSP ES-10A	Electrical Systems (Isofootcandle Diagrams)
RSP ES-10B	Electrical Systems (Isofootcandle Diagrams)
RSP ES-11	Electrical Systems (Foundation Installations)
ES-13A	Electrical Systems (Splicing Details)
ES-13B	Electrical Systems (Fuse Rating, Kinking and Banding Detail)
ES-14B	Electrical Systems (Control Assembly Wiring Diagrams)
RSP ES-16B	Electrical Systems (Closed Circuit Television, 25' to 45' Pole)

CANCELED STANDARD PLANS LIST

The standard plan sheets listed below are canceled and not applicable to this contract.

Plan No.	Date Canceled	Plan No.	Date Canceled	Plan No.	Date Canceled
A77A1	07-19-13	A77J4	07-19-13	ES-6J	07-19-13
A77A2	07-19-13	A77K1	07-19-13	ES-7I	07-19-13
A77B1	07-19-13	A77K2	07-19-13	ES-8	01-20-12
A77C1	07-19-13	P3	07-19-13	ES-10	07-20-12
A77C2	07-19-13	C8A	07-19-13		
A77C3	07-19-13	C8B	07-19-13		
A77C4	07-19-13	C8C	07-19-13		
RSP A77C5	07-19-13	B3-1	04-20-12		
RSP A77C6	07-19-13	B3-2	04-20-12		
RSP A77C7	07-19-13	B3-3	04-20-12		
RSP A77C8	07-19-13	B3-4	04-20-12		
RSP A77C9	07-19-13	B3-7	04-20-12		
RSP A77C10	07-19-13	B3-8	04-20-12		
A77E1	07-19-13	S7	07-19-13		
A77E2	07-19-13	S14	07-19-13		
A77E3	07-19-13	S41	07-19-13		
A77E4	07-19-13	S42	07-19-13		
A77E5	07-19-13	S43	07-19-13		
A77E6	07-19-13	S44	07-19-13		
A77F1	07-19-13	S45	07-19-13		
A77F2	07-19-13	S46	07-19-13		
A77F3	07-19-13	S47	07-19-13		
A77F4	07-19-13	S120	07-19-13		
A77F5	07-19-13	S121	07-19-13		
A77G1	07-19-13	S122	07-19-13		
A77G2	07-19-13	S123	07-19-13		
A77G3	07-19-13	S124	07-19-13		
A77G4	07-19-13	S125	07-19-13		
A77G5	07-19-13	S126	07-19-13		
A77G6	07-19-13	S127	07-19-13		
A77G7	07-19-13	S128	07-19-13		
A77G8	07-19-13	S129	07-19-13		
A77H1	07-19-13	S130	07-19-13		
A77H2	07-19-13	S131	07-19-13		
A77H3	07-19-13	S132	07-19-13		
A77I1	07-19-13	S133	07-19-13		
A77I2	07-19-13	S134	07-19-13		
A77J1	07-19-13	S135	07-19-13		
A77J2	07-19-13	ES-6H	07-19-13		
A77J3	07-19-13	ES-6I	07-19-13		

NOTICE TO BIDDERS

Bids open Thursday, June 19, 2014

Dated April 28, 2014

General work description: Construct 4 lane highway.

The Department will receive sealed bids for CONSTRUCTION ON STATE HIGHWAY IN SAN DIEGO COUNTY NEAR BONSALL AND FALLBROOK ON ROUTE 15 FROM 0.3 MILE SOUTH TO 0.3 MILE NORTH OF ROUTE 76/15 SEPARATION AND ON ROUTE 76 FROM 0.4 MILE WEST OF SOUTH MISSION ROAD TO 0.5 MILE EAST OF ROUTE 76/15 SEPARATION.

District-County-Route-Post Mile: 11-SD-15,76-R46.2/R46.8, R12.1/R17.7

Contract No. 11-257154

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

The DBE Contract goal is 10 percent.

Federal-aid project no.:

STPL-6211(114)E

TPF-2012(001)E

For the Federal training program, the number of trainees or apprentices is 30.

Bids must be on a unit price basis.

Complete the work, excluding plant establishment work, within 700 working days.

Complete the work, including plant establishment work, within 825 working days.

Complete the plant establishment work within 125 working days.

The estimated cost of the project is \$91,000,000.

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*.

Present bidders' inquiries to the Department and view the Department's responses at:

http://www.dot.ca.gov/hq/esc/oe/inquiry/bid_inquiries.php

Questions about alleged patent ambiguity of the plans, specifications, or estimate must be asked before bid opening. After bid opening, the Department does not consider these questions 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. Additional information is provided in the Excluded Parties List System at <https://www.epls.gov>.

Department of Transportation

D11

BID ITEM LIST

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
1	070030	LEAD COMPLIANCE PLAN	LS	LUMP SUM
2	080050	PROGRESS SCHEDULE (CRITICAL PATH METHOD)	LS	LUMP SUM
3	090100	TIME-RELATED OVERHEAD (WDAY)	WDAY	700
4	120090	CONSTRUCTION AREA SIGNS	LS	LUMP SUM
5	120100	TRAFFIC CONTROL SYSTEM	LS	LUMP SUM
6	120116	TYPE II BARRICADE	EA	5
7	120120	TYPE III BARRICADE	EA	230
8	120149	TEMPORARY PAVEMENT MARKING (PAINT)	SQFT	4,730
9	120159	TEMPORARY TRAFFIC STRIPE (PAINT)	LF	54,500
10	120199	TRAFFIC PLASTIC DRUM	EA	1,140
11	120300	TEMPORARY PAVEMENT MARKER	EA	1,250
12	128651	PORTABLE CHANGEABLE MESSAGE SIGN (EA)	EA	8
13	129000	TEMPORARY RAILING (TYPE K)	LF	41,400
14	129100	TEMPORARY CRASH CUSHION MODULE	EA	490
15	027349	TEMPORARY ALTERNATIVE CRASH CUSHION SYSTEM	EA	18
16	130100	JOB SITE MANAGEMENT	LS	LUMP SUM
17	130300	PREPARE STORM WATER POLLUTION PREVENTION PLAN	LS	LUMP SUM
18	130310	RAIN EVENT ACTION PLAN	EA	27
19	130320	STORM WATER SAMPLING AND ANALYSIS DAY	EA	27
20	130330	STORM WATER ANNUAL REPORT	EA	4

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
21	130505	MOVE-IN/MOVE-OUT (TEMPORARY EROSION CONTROL)	EA	12
22	130530	TEMPORARY HYDRAULIC MULCH (BONDED FIBER MATRIX)	SQYD	1,260,000
23	130620	TEMPORARY DRAINAGE INLET PROTECTION	EA	260
24	130640	TEMPORARY FIBER ROLL	LF	744,000
25	130690	TEMPORARY STRAW BALE BARRIER	EA	620
26	130710	TEMPORARY CONSTRUCTION ENTRANCE	EA	55
27	130730	STREET SWEEPING	LS	LUMP SUM
28	130900	TEMPORARY CONCRETE WASHOUT	LS	LUMP SUM
29	141000	TEMPORARY FENCE (TYPE ESA)	LF	10,100
30	027350	TEMPORARY ARROYO TOAD FENCE	LF	9,660
31	141120	TREATED WOOD WASTE	LB	26,500
32	027351	PRE-MANUFACTURED BAT HOUSE	EA	2
33	150203	ABANDON CULVERT (EA)	EA	10
34	027352	ABANDON SEWER MANHOLE	EA	32
35	027353	ABANDON WATERLINE	EA	2
36	150230	DESTROY WELL	EA	46
37	150241	ABANDON SEWER	LS	LUMP SUM
38	027354	REMOVE STEEL CASING	EA	150
39	150605	REMOVE FENCE	LF	9,360
40	150620	REMOVE GATE	EA	8

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
41	150655	REMOVE BARRIER	LF	1,890
42	150661	REMOVE GUARDRAIL	LF	1,750
43	150685	REMOVE IRRIGATION FACILITY	LS	LUMP SUM
44	150711	REMOVE PAINTED TRAFFIC STRIPE	LF	101,000
45	150712	REMOVE PAINTED PAVEMENT MARKING	SQFT	2,580
46	150714	REMOVE THERMOPLASTIC TRAFFIC STRIPE	LF	11,900
47	150715	REMOVE THERMOPLASTIC PAVEMENT MARKING	SQFT	590
48	150742	REMOVE ROADSIDE SIGN	EA	98
49	150749	REMOVE METAL POST	EA	17
50	027355	REMOVE MUD, SAND AND DEBRIS (IN CULVERT)	LF	1,550
51	150809	REMOVE CULVERT (LF)	LF	3,880
52	027356	REMOVE HYDRANT (RAINBOW)	EA	1
53	150820	REMOVE INLET	EA	10
54	150821	REMOVE HEADWALL	EA	7
55	027357	REMOVE AUTOMATIC AIR RELEASE AND VACUUM VALVE	EA	3
56	150857	REMOVE ASPHALT CONCRETE SURFACING	SQFT	13,800
57	150860	REMOVE BASE AND SURFACING	CY	12,200
58	027358	MAINTAIN ARROYO TOAD FENCE	LF	33,100
59	152255	RESET MAILBOX	EA	10
60	027359	RELOCATE HYDRANT (RAINBOW)	EA	1

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
61	152372	RELOCATE CONCRETE BARRIER (TYPE K)	LF	1,400
62	152388	RELOCATE CRASH CUSHION	EA	2
63	152401	ADJUST WATER METER TO GRADE	EA	8
64	152430	ADJUST INLET	EA	4
65	152432	ADJUST MANHOLE	EA	1
66	027360	ADJUST FIRE HYDRANT (RAINBOW)	EA	1
67	027361	ADJUST WATER VALVE (RAINBOW)	EA	2
68	027362	ADJUST SEWER MANHOLE (RAINBOW)	EA	53
69	152604	MODIFY INLET	EA	1
70	027363	MODIFY SEWER MANHOLE	EA	5
71	153103	COLD PLANE ASPHALT CONCRETE PAVEMENT	SQYD	12,700
72	153121	REMOVE CONCRETE (CY)	CY	710
73	155006	CAP RISER	EA	2
74	155232	SAND BACKFILL	CY	280
75	156535	REMOVE BOX CULVERT	EA	1
76	157550	BRIDGE REMOVAL	LS	LUMP SUM
77	160102	CLEARING AND GRUBBING (LS)	LS	LUMP SUM
78	170101	DEVELOP WATER SUPPLY	LS	LUMP SUM
79	190101	ROADWAY EXCAVATION	CY	479,000
80	027364	ROADWAY EXCAVATION (TYPE C)	CY	718,000

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
81	190160	ROCK EXCAVATION (CONTROLLED BLASTING)	CY	47,100
82	027365	SETTLEMENT PLATFORM	EA	9
83 (F)	192003	STRUCTURE EXCAVATION (BRIDGE)	CY	1,588
84 (F)	193003	STRUCTURE BACKFILL (BRIDGE)	CY	1,200
85	193006	STRUCTURE BACKFILL (SLURRY CEMENT)	CY	970
86	194001	DITCH EXCAVATION	CY	1,830
87	198010	IMPORTED BORROW (CY)	CY	92,200
88	198209	SUBGRADE ENHANCEMENT GEOTEXTILE, CLASS B2	SQYD	12,500
89	200002	ROADSIDE CLEARING	LS	LUMP SUM
90	200122	WEED GERMINATION	SQYD	1,080,000
91	027366	RELOCATE WATER METER (RAINBOW)	EA	1
92	202038	PACKET FERTILIZER	EA	329,000
93	204003	PLANT (GROUP C)	EA	30
94	204008	PLANT (GROUP H)	EA	390
95	204011	PLANT (GROUP K)	EA	40
96	204013	PLANT (GROUP M)	EA	227,000
97	204035	PLANT (GROUP A)	EA	297,000
98	204036	PLANT (GROUP B)	EA	18,700
99	204038	PLANT (GROUP U)	EA	1,070
100	204045	SOD	SQYD	26,700

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
101	204096	MAINTAIN EXISTING PLANTED AREAS	LS	LUMP SUM
102	204099	PLANT ESTABLISHMENT WORK	LS	LUMP SUM
103	205034	DECOMPOSED GRANITE	SQFT	67,300
104	205035	WOOD MULCH	CY	2,840
105	027367	ROCK MULCH (TYPE 1)	SQYD	7,190
106	027368	ROCK MULCH (TYPE 2)	SQYD	560
107	027369	ROCK MULCH (TYPE 3)	SQYD	330
108	027370	GRAVEL STABILIZER	CY	11
109	206400	CHECK AND TEST EXISTING IRRIGATION FACILITIES	LS	LUMP SUM
110	206402	OPERATE EXISTING IRRIGATION FACILITIES	LS	LUMP SUM
111	206560	CONTROL AND NEUTRAL CONDUCTORS	LS	LUMP SUM
112	027371	1" REMOTE CONTROL VALVE WITH PRESSURE REGULATOR	EA	40
113	027372	1 1/2" REMOTE CONTROL VALVE WITH PRESSURE REGULATOR	EA	630
114	027373	1 1/2" ELECTRIC REMOTE CONTROL VALVE (MASTER)	EA	1
115	027374	2" ELECTRIC REMOTE CONTROL VALVE (MASTER)	EA	12
116	027375	3" ELECTRIC REMOTE CONTROL VALVE (MASTER)	EA	1
117	027376	12 STATION EXPANSION MODULE	EA	5
118	206758	24-32 STATION IRRIGATION CONTROLLER (WALL MOUNTED)	EA	3
119	206759	30-42 STATION IRRIGATION CONTROLLER (WALL MOUNTED)	EA	4
120	027377	48 STATION IRRIGATION CONTROLLER (WALL MOUNTED)	EA	6

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
121	206921	SOLAR POWERED IRRIGATION CONTROLLER	EA	8
122 (F)	208008	3" GALVANIZED STEEL PIPE (SUPPLY LINE)	LF	30
123	027378	1" GALVANIZED STEEL PIPE (CONDUIT)	LF	30
124 (F)	208028	3" SUPPLY LINE (BRIDGE)	LF	1,494
125	208301	IRRIGATION CONTROLLER ENCLOSURE CABINET	EA	10
126	027379	IRRIGATION CONTROLLER ENCLOSURE (SOLAR)	EA	8
127	027380	2" TEMPORARY WATER METER ASSEMBLY	EA	1
128	027381	WATER METER (RAINBOW)	EA	11
129	208416	CERTIFY EXISTING BACKFLOW PREVENTERS	LS	LUMP SUM
130	208425	1 1/2" BACKFLOW PREVENTER ASSEMBLY	EA	1
131	208426	2" BACKFLOW PREVENTER ASSEMBLY	EA	10
132	208440	BACKFLOW PREVENTER ENCLOSURE	EA	11
133	208445	TREE WELL SPRINKLER ASSEMBLY	EA	1,220
134	208446	RISER SPRINKLER ASSEMBLY (GEAR DRIVEN)	EA	9,430
135	208447	POP-UP SPRINKLER ASSEMBLY (GEAR DRIVEN)	EA	770
136	208449	POP-UP SPRINKLER ASSEMBLY	EA	180
137	208565	REPLACE VALVE BOX COVER	EA	45
138	208574	1 1/2" GATE VALVE	EA	12
139	208575	2" GATE VALVE	EA	160
140	208588	3" GATE VALVE	EA	43

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
141	208589	4" GATE VALVE	EA	1
142	208590	6" GATE VALVE	EA	10
143 (F)	208595	1" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE)	LF	197,746
144 (F)	208596	1 1/4" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE)	LF	87,695
145 (F)	208597	1 1/2" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE)	LF	29,040
146 (F)	208598	2" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE)	LF	35,453
147 (F)	208606	2 1/2" PLASTIC PIPE (CLASS 315) (SUPPLY LINE)	LF	53,615
148 (F)	208607	3" PLASTIC PIPE (CLASS 315) (SUPPLY LINE)	LF	13,959
149 (F)	208608	4" PLASTIC PIPE (CLASS 315) (SUPPLY LINE)	LF	52,797
150 (F)	208609	6" PLASTIC PIPE (CLASS 315) (SUPPLY LINE)	LF	7,810
151	208640	PRESSURE REGULATING VALVE	EA	1
152	027382	PRESSURE REGULATING VALVE (RAINBOW)	EA	11
153	208649	QUICK COUPLING VALVE	EA	39
154	027383	2" COMBINATION AIR RELIEF VALVE	EA	16
155	208683	BALL VALVE	EA	30
156	208738	8" CORRUGATED HIGH DENSITY POLYETHYLENE PIPE CONDUIT	LF	1,390
157	208739	10" CORRUGATED HIGH DENSITY POLYETHYLENE PIPE CONDUIT	LF	8
158	208740	12" CORRUGATED HIGH DENSITY POLYETHYLENE PIPE CONDUIT	LF	280
159	027384	6" PLASTIC PIPE (SCHEDULE 40)(CONDUIT)	LF	2,450
160	027385	12" PLASTIC PIPE (SCHEDULE 40)	LF	660

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
161	210010	MOVE-IN/MOVE-OUT (EROSION CONTROL)	EA	12
162	210110	IMPORTED TOPSOIL (CY)	CY	4,920
163	210130	DUFF	ACRE	170
164	210211	EROSION CONTROL (DRY SEED) (ACRE)	ACRE	170
165	210250	EROSION CONTROL (BONDED FIBER MATRIX) (SQFT)	SQFT	4,410,000
166	210251	EROSION CONTROL (BONDED FIBER MATRIX) (ACRE)	ACRE	99
167	210270	ROLLED EROSION CONTROL PRODUCT (NETTING)	SQFT	140,000
168	210280	ROLLED EROSION CONTROL PRODUCT (BLANKET)	SQFT	282,000
169	210350	FIBER ROLLS	LF	298,000
170	027386	DRAINAGE INLET PROTECTION (EROSION CONTROL)	EA	140
171	210600	COMPOST	SQFT	238,000
172	210630	INCORPORATE MATERIALS	SQFT	238,000
173	260203	CLASS 2 AGGREGATE BASE (CY)	CY	70,700
174	374002	ASPHALTIC EMULSION (FOG SEAL COAT)	TON	22
175	377501	SLURRY SEAL	TON	410
176	390300	HOT MIX ASPHALT, SUPERPAVE (TYPE A)	TON	148,000
177	391007	PAVING ASPHALT (BINDER, GEOSYNTHETIC PAVEMENT INTERLAYER)	TON	8
178	393004	GEOSYNTHETIC PAVEMENT INTERLAYER (PAVING FABRIC)	SQYD	6,700
179	394060	DATA CORE	LS	LUMP SUM
180	394074	PLACE HOT MIX ASPHALT DIKE (TYPE C)	LF	190

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
181	394076	PLACE HOT MIX ASPHALT DIKE (TYPE E)	LF	4,200
182	394077	PLACE HOT MIX ASPHALT DIKE (TYPE F)	LF	140
183	394090	PLACE HOT MIX ASPHALT (MISCELLANEOUS AREA)	SQYD	630
184	397005	TACK COAT	TON	86
185	400050	CONTINUOUSLY REINFORCED CONCRETE PAVEMENT	CY	940
186	027387	TEMPORARY HAUL BRIDGE	LS	LUMP SUM
187	490591	60" PERMANENT STEEL CASING	LF	2,240
188	490607	48" CAST-IN-DRILLED-HOLE CONCRETE PILING	LF	758
189	490609	60" CAST-IN-DRILLED-HOLE CONCRETE PILING	LF	2,240
190	490684	48" CAST-IN-DRILLED-HOLE CONCRETE PILING (ROCK SOCKET)	LF	16
191	490801	STEEL SHEET PILING	SQFT	2,590
192	500001	PRESTRESSING CAST-IN-PLACE CONCRETE	LS	LUMP SUM
193 (F)	510051	STRUCTURAL CONCRETE, BRIDGE FOOTING	CY	113
194 (F)	510053	STRUCTURAL CONCRETE, BRIDGE	CY	3,259
195 (F)	510086	STRUCTURAL CONCRETE, APPROACH SLAB (TYPE N)	CY	486
196 (F)	510090	STRUCTURAL CONCRETE, BOX CULVERT	CY	3,019
197 (F)	027388	STRUCTURAL CONCRETE, JUNCTION STRUCTURE	CY	29
198 (F)	510092	STRUCTURAL CONCRETE, HEADWALL	CY	1,324
199 (F)	510502	MINOR CONCRETE (MINOR STRUCTURE)	CY	782
200 (F)	027389	CONCRETE SLOPE ANCHOR	CY	28

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
201	512283	FURNISH PRECAST PRESTRESSED CONCRETE BULB-TEE GIRDER (140'-150')	EA	10
202 (F)	512500	ERECT PRECAST PRESTRESSED CONCRETE GIRDER	EA	10
203	519088	JOINT SEAL (MR 1")	LF	463
204	519102	JOINT SEAL (TYPE AL)	LF	26
205 (F)	520102	BAR REINFORCING STEEL (BRIDGE)	LB	1,285,261
206 (F)	520107	BAR REINFORCING STEEL (BOX CULVERT)	LB	713,038
207	560245	FURNISH LAMINATED PANEL SIGN (1"-TYPE B)	SQFT	360
208	560248	FURNISH SINGLE SHEET ALUMINUM SIGN (0.063"-UNFRAMED)	SQFT	1,940
209	560249	FURNISH SINGLE SHEET ALUMINUM SIGN (0.080"-UNFRAMED)	SQFT	150
210	560251	FURNISH SINGLE SHEET ALUMINUM SIGN (0.063"-FRAMED)	SQFT	170
211	560252	FURNISH SINGLE SHEET ALUMINUM SIGN (0.080"-FRAMED)	SQFT	340
212	027390	MITIGATION SIGN (TYPE 1)	EA	19
213	027391	MITIGATION SIGN (TYPE 2)	EA	7
214	562002	METAL (BARRIER MOUNTED SIGN)	LB	1,140
215	566011	ROADSIDE SIGN - ONE POST	EA	210
216	566012	ROADSIDE SIGN - TWO POST	EA	23
217	027392	ROADSIDE SIGN - ONE POST (WEED CONTROL MAT RUBBER)	EA	5
218	027393	FLUSH MOUNTED SIGN	EA	25
219	568001	INSTALL SIGN (STRAP AND SADDLE BRACKET METHOD)	EA	23
220	568017	INSTALL ROADSIDE SIGN PANEL ON EXISTING POST	EA	1

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
221	568023	INSTALL ROADSIDE SIGN (LAMINATED WOOD BOX POST)	EA	2
222	575005	TIMBER RETAINING WALL	SQFT	2,360
223	591200	ROCK STAIN	SQFT	277,000
224	620100	18" ALTERNATIVE PIPE CULVERT	LF	4,460
225	620140	24" ALTERNATIVE PIPE CULVERT	LF	13,700
226	620380	60" ALTERNATIVE PIPE CULVERT	LF	80
227	623000	TEMPORARY CULVERT	LF	2,620
228	642115	18" SLOTTED PLASTIC PIPE	LF	160
229	650014	18" REINFORCED CONCRETE PIPE	LF	130
230	650018	24" REINFORCED CONCRETE PIPE	LF	6,060
231	650022	30" REINFORCED CONCRETE PIPE	LF	1,060
232	650026	36" REINFORCED CONCRETE PIPE	LF	1,060
233	650030	42" REINFORCED CONCRETE PIPE	LF	600
234	650034	48" REINFORCED CONCRETE PIPE	LF	590
235	650042	60" REINFORCED CONCRETE PIPE	LF	600
236	650046	66" REINFORCED CONCRETE PIPE	LF	250
237	665132	30" BITUMINOUS COATED CORRUGATED STEEL PIPE (.109" THICK)	LF	150
238	665147	48" BITUMINOUS COATED CORRUGATED STEEL PIPE (.109" THICK)	LF	24
239	680902	6" PERFORATED PLASTIC PIPE UNDERDRAIN	LF	1,340
240	700617	DRAINAGE INLET MARKER	EA	35

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
241	703233	GRATED LINE DRAIN	LF	390
242	705311	18" ALTERNATIVE FLARED END SECTION	EA	2
243	705315	24" ALTERNATIVE FLARED END SECTION	EA	1
244	707467	36" REINFORCED CONCRETE PIPE RISER	LF	38
245	720118	ROCK SLOPE PROTECTION (2T, METHOD A)	CY	1,360
246	721013	ROCK SLOPE PROTECTION (1/4 T, METHOD B) (CY)	CY	35,700
247	721015	ROCK SLOPE PROTECTION (LIGHT, METHOD B) (CY)	CY	7,280
248	721022	ROCK SLOPE PROTECTION (1T, METHOD B)	CY	300
249	721026	ROCK SLOPE PROTECTION (NO. 1, METHOD B) (CY)	CY	250
250	721028	ROCK SLOPE PROTECTION (NO. 2, METHOD B) (CY)	CY	14,100
251	721030	ROCK SLOPE PROTECTION (1/2 T, METHOD B) (CY)	CY	530
252	721400	CONCRETE (SLOPE PROTECTION)	CY	460
253	721420	CONCRETE (DITCH LINING)	CY	540
254	721810	SLOPE PAVING (CONCRETE)	CY	9
255	722020	GABION	CY	730
256	729011	ROCK SLOPE PROTECTION FABRIC (CLASS 8)	SQYD	12,100
257	729012	ROCK SLOPE PROTECTION FABRIC (CLASS 10)	SQYD	890
258	730040	MINOR CONCRETE (GUTTER) (LF)	LF	435
259	730070	DETECTABLE WARNING SURFACE	SQFT	570
260	731502	MINOR CONCRETE (MISCELLANEOUS CONSTRUCTION)	CY	1,270

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
261	735000	PARKING BUMPER (PRECAST CONCRETE)	EA	140
262 (F)	750001	MISCELLANEOUS IRON AND STEEL	LB	93,434
263	027394	8" PVC SEWER PIPE (SDR-35)	LF	550
264	027395	12" PVC SEWER PIPE (SDR-35)	LF	240
265	027396	18" PVC SEWER PIPE (PS-46)	LF	10,400
266	027397	21" PVC SEWER PIPE (PS-46)	LF	1,050
267	027398	24" PVC SEWER PIPE (PS-46)	LF	750
268	027399	12" PVC FORCE MAIN (C-900)	LF	29
269	027400	RECONNECT EXISTING SEWER LATERAL	EA	12
270	027401	TEMPORARY BYPASS	EA	7
271	027402	20" STEEL CASING (SEWER)	LF	80
272	027403	30" STEEL CASING (SEWER)	LF	310
273	027404	36" STEEL CASING (SEWER)	LF	30
274	027405	42" STEEL CASING (SEWER)	LF	50
275	027406	60" PRECAST PVC LINED CONCRETE MANHOLE	EA	11
276	027407	60" PRECAST CONCRETE MANHOLE	EA	42
277	027408	72" PRECAST CONCRETE MANHOLE	EA	2
278	027409	84" PRECAST PVC LINED CONCRETE MANHOLE	EA	1
279	027410	6" FIRE HYDRANT ASSEMBLY	EA	3
280	027411	2" AUTOMATIC AIR RELEASE AND VACUUM RELIEF VALVE	EA	7

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
281	027412	BLOW OFF ASSEMBLY	EA	4
282	027413	8" DUCTILE IRON WATER PIPE	LF	1,980
283	027414	10" STEEL CEMENT-MORTAR LINED AND COATED WATER PIPE (0.375" THICK)	LF	150
284	027415	16" STEEL CEMENT-MORTAR LINED AND COATED WATER PIPE (0.375" THICK)	LF	180
285	027416	24" STEEL CEMENT-MORTAR LINED AND COATED WATER PIPE (0.375" THICK)	LF	60
286	027417	INSULATING FLANGE KIT	EA	4
287	027418	CONNECT TO WATER LINE	EA	4
288	027419	36" STEEL CASING (WATER)	LF	160
289	027420	8" PLUG VALVE	LF	3
290	027421	10" PLUG VALVE	EA	1
291	027422	24" PLUG VALVE	EA	2
292	027423	TRENCHLESS CASING INSTALLATION	LF	68
293	027424	CABLE BARRIER FENCE	LF	20,300
294	800103	TEMPORARY FENCE (TYPE CL-6)	LF	230
295	800360	CHAIN LINK FENCE (TYPE CL-6)	LF	810
296	027425	WILDLIFE FENCE (TYPE 1)	LF	40,200
297	027426	WILDLIFE FENCE (TYPE 2)	LF	4,310
298	027427	ARROYO TOAD FENCE	LF	20,100
299	027428	RAIL FENCE	LF	1,820
300	027429	CONTINUOUS POST BARRICADE	LF	20

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
301	802901	4' CHAIN LINK GATE (TYPE CL-8)	EA	18
302	802920	6' CHAIN LINK GATE (TYPE CL-8)	EA	37
303	027430	10' CHAIN LINK GATE (TYPE CL-8)	EA	4
304	027431	TUBULAR STEEL GATE	EA	10
305	820107	DELINEATOR (CLASS 1)	EA	150
306	820110	MILEPOST MARKER	EA	36
307	820131	OBJECT MARKER (TYPE K)	EA	2
308 (F)	833032	CHAIN LINK RAILING (TYPE 7)	LF	1,409
309	833073	WILDLIFE PASSAGE WAY (TYPE M)	EA	2
310 (F)	833088	TUBULAR HANDRAILING	LF	1,175
311 (F)	839521	CABLE RAILING	LF	833
312	839543	TRANSITION RAILING (TYPE WB-31)	EA	4
313	839584	ALTERNATIVE IN-LINE TERMINAL SYSTEM	EA	4
314	839604	CRASH CUSHION (REACT 9CBB)	EA	8
315	027432	CONCRETE BARRIER (TYPE 60 MODIFIED)	LF	16,000
316	839699	CONCRETE BARRIER (TYPE 60P)	LF	72
317	839701	CONCRETE BARRIER (TYPE 60)	LF	4,410
318 (F)	839702	CONCRETE BARRIER (TYPE 60A)	LF	169
319 (F)	839725	CONCRETE BARRIER (TYPE 736)	LF	1,208
320	840655	PAINT TRAFFIC STRIPE (1-COAT)	LF	13,800

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
321	840656	PAINT TRAFFIC STRIPE (2-COAT)	LF	133,000
322	846001	4" THERMOPLASTIC TRAFFIC STRIPE (ENHANCED WET NIGHT VISIBILITY)	LF	85,400
323	846002	4" THERMOPLASTIC TRAFFIC STRIPE (ENHANCED WET NIGHT VISIBILITY) (BROKEN 6-1)	LF	150
324	846005	4" THERMOPLASTIC TRAFFIC STRIPE (ENHANCED WET NIGHT VISIBILITY) (BROKEN 36-12)	LF	51,100
325	846007	6" THERMOPLASTIC TRAFFIC STRIPE (ENHANCED WET NIGHT VISIBILITY)	LF	47,600
326	846008	6" THERMOPLASTIC TRAFFIC STRIPE (ENHANCED WET NIGHT VISIBILITY) (BROKEN 8-4)	LF	980
327	846009	8" THERMOPLASTIC TRAFFIC STRIPE (ENHANCED WET NIGHT VISIBILITY)	LF	9,020
328	846010	8" THERMOPLASTIC TRAFFIC STRIPE (ENHANCED WET NIGHT VISIBILITY) (BROKEN 12-3)	LF	300
329	846012	THERMOPLASTIC CROSSWALK AND PAVEMENT MARKING (ENHANCED WET NIGHT VISIBILITY)	SQFT	8,770
330	850101	PAVEMENT MARKER (NON-REFLECTIVE)	EA	4,380
331	850111	PAVEMENT MARKER (RETROREFLECTIVE)	EA	6,350
332	027433	SAN DIEGO PARK AND RIDE ELECTRICAL FACILITY	LS	LUMP SUM
333	860090	MAINTAINING EXISTING TRAFFIC MANAGEMENT SYSTEM ELEMENTS DURING CONSTRUCTION	LS	LUMP SUM
334	860251	SIGNAL AND LIGHTING (LOCATION 1)	LS	LUMP SUM
335	860252	SIGNAL AND LIGHTING (LOCATION 2)	LS	LUMP SUM
336	860253	SIGNAL AND LIGHTING (LOCATION 3)	LS	LUMP SUM
337	860254	SIGNAL AND LIGHTING (LOCATION 4)	LS	LUMP SUM
338	027434	SIGNAL AND LIGHTING (COUNTY)	LS	LUMP SUM
339	860401	LIGHTING	LS	LUMP SUM
340	027435	LIGHTING (COUNTY)	LS	LUMP SUM

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
341	860407	LIGHTING (PARKING LOT)	LS	LUMP SUM
342	860415	LIGHTING (STAGE CONSTRUCTION)	LS	LUMP SUM
343	860758	LIGHTING CONDUIT (BRIDGE) (LF)	LF	580
344	860774	SPRINKLER CONTROL CONDUIT (BRIDGE) (LF)	LF	740
345	860797	ELECTRIC SERVICE (IRRIGATION)	LS	LUMP SUM
346	860931	TRAFFIC MONITORING STATION (LOCATION 1)	LS	LUMP SUM
347	860932	TRAFFIC MONITORING STATION (LOCATION 2)	LS	LUMP SUM
348	860990	CLOSED CIRCUIT TELEVISION SYSTEM	LS	LUMP SUM
349	861501	MODIFY SIGNAL AND LIGHTING	LS	LUMP SUM
350	999990	MOBILIZATION	LS	LUMP SUM

SPECIAL PROVISIONS ORGANIZATION

Special provisions are under headings that correspond with the main-section headings of the *Standard Specifications*. A main-section heading is a heading shown in the table of contents of the *Standard Specifications*.

Each special provision begins with a revision clause that describes or introduces a revision to the *Standard Specifications* as revised by any revised standard specification.

Any paragraph added or deleted by a revision clause does not change the paragraph numbering of the *Standard Specifications* for any other reference to a paragraph of the *Standard Specifications*.

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DIVISION I GENERAL PROVISIONS 1 GENERAL

Add to section 1-1.01:

Bid Items and Applicable Sections

Item code	Item description	Applicable section
027349	TEMPORARY ALTERNATIVE CRASH CUSHION SYSTEM	12
027350	TEMPORARY ARROYO TOAD FENCE	14
027351	PRE-MANUFACTURED BAT HOUSE	14
027352	ABANDON SEWER MANHOLE	77
027353	ABANDON WATERLINE	77
027354	REMOVE STEEL CASING	15
027355	REMOVE MUD, SAND AND DEBRIS (IN CULVERT)	15
027356	REMOVE HYDRANT (RAINBOW)	77
027357	REMOVE AUTOMATIC AIR RELEASE AND VACUUM VALVE	77
027358	MAINTAIN ARROYO TOAD FENCE	14
027359	RELOCATE HYDRANT (RAINBOW)	77
027360	ADJUST FIRE HYDRANT (RAINBOW)	77
027361	ADJUST WATER VALVE (RAINBOW)	77
027362	ADJUST SEWER MANHOLE (RAINBOW)	77
027363	MODIFY SEWER MANHOLE	77
027364	ROADWAY EXCAVATION (TYPE C)	19
027365	SETTEMENT PLATFORM	19
027366	RELOCATE WATER METER (RAINBOW)	77
027367	ROCK MULCH (TYPE 1)	20
027368	ROCK MULCH (TYPE 2)	20
027369	ROCK MULCH (TYPE 3)	20
027370	GRAVEL STABILIZER	20
027371	1" REMOTE CONTROL VALVE WITH PRESSURE REGULATOR	20
027372	1 1/2" REMOTE CONTROL VALVE WITH PRESSURE REGULATOR	20
027373	1 1/2" ELECTRIC REMOTE CONTROL VALVE (MASTER)	20
027374	2" ELECTRIC REMOTE CONTROL VALVE (MASTER)	20
027375	3" ELECTRIC REMOTE CONTROL VALVE (MASTER)	20
027376	12 STATION EXPANSION MODULE	20
027377	48 STATION IRRIGATION CONTROLLER (WALL MOUNTED)	20
027378	1" GALVANIZED STEEL PIPE (CONDUIT)	20

Item code	Item description	Applicable section
027379	IRRIGATION CONTROLLER ENCLOSURE (SOLAR)	20
027380	2" TEMPORARY WATER METER ASSEMBLY	20
027381	WATER METER (RAINBOW)	77
027382	PRESSURE REGULATING VALVE (RAINBOW)	77
027383	2" COMBINATION AIR RELIEF VALVE	77
027384	6" PLASTIC PIPE (SCHEDULE 40) (CONDUIT)	20
027385	12" PLASTIC PIPE (SCHEDULE 40)	20
027386	DRAINAGE INLET PROTECTION (EROSION CONTROL)	21
027387	TEMPORARY HAUL BRIDGE	48
027388	STRUCTURAL CONCRETE, JUNCTION STRUCTURE	51
027389	CONCRETE SLOPE ANCHOR	77
027390	MITIGATION SIGN (TYPE 1)	56
027391	MITIGATION SIGN (TYPE 2)	56
027392	ROADSIDE SIGN - ONE POST (WEED CONTROL MAT RUBBER)	56
027393	FLUSH MOUNTED SIGN	56
027394	8" PVC SEWER PIPE (SDR-35)	77
027395	12" PVC SEWER PIPE (SDR-35)	77
027396	18" PVC SEWER PIPE (PS-46)	77
027397	21" PVC SEWER PIPE (PS-46)	77
027398	24" PVC SEWER PIPE (PS-46)	77
027399	12" PVC FORCE MAIN (C-900)	77
027400	RECONNECT EXISTING SEWER LATERAL	77
027401	TEMPORARY BYPASS	77
027402	20" STEEL CASING (SEWER)	77
027403	30" STEEL CASING (SEWER)	77
027404	36" STEEL CASING (SEWER)	77
027405	42" STEEL CASING (SEWER)	77
027406	60" PRECAST PVC LINED CONCRETE MANHOLE	77
027407	60" PRECAST CONCRETE MANHOLE	77
027408	72" PRECAST CONCRETE MANHOLE	77
027409	84" PRECAST PVC LINED CONCRETE MANHOLE	77
027410	6" FIRE HYDRANT ASSEMBLY	77
027411	2" AUTOMATIC AIR RELEASE AND VACUUM RELIEF VALVE	77
027412	BLOW OFF ASSEMBLY	77
027413	8" DUCTILE IRON WATER PIPE	77
027414	10" STEEL CEMENT-MORTAR LINED AND COATED WATER PIPE (0.375" THICK)	77
027415	16" STEEL CEMENT-MORTAR LINED AND COATED WATER PIPE (0.375" THICK)	77
027416	24" STEEL CEMENT-MORTAR LINED AND COATED WATER PIPE (0.375" THICK)	77
027417	INSULATING FLANGE KIT	77
027418	CONNECT TO WATER LINE	77
027419	36" STEEL CASING (WATER)	77
027420	8" PLUG VALVE	77
027421	10" PLUG VALVE	77
027422	24" PLUG VALVE	77
027423	TRENCHLESS CASING INSTALLATION	78
027424	CABLE BARRIER FENCE	80
027425	WILDLIFE FENCE (TYPE 1)	14
027426	WILDLIFE FENCE (TYPE 2)	14
027427	ARROYO TOAD FENCE	14
027428	RAIL FENCE	80
027429	CONTINUOUS POST BARRICADE	80
027430	10' CHAIN LINK GATE (TYPE CL-8)	80

Item code	Item description	Applicable section
027431	TUBULAR STEEL GATE	80
027432	CONCRETE BARRIER (TYPE 60 MODIFIED)	83
027433	SAN DIEGO PARK AND RIDE ELECTRICAL FACILITY	86
027434	SIGNAL AND LIGHTING (COUNTY)	86
027435	LIGHTING (COUNTY)	86

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2 BIDDING

Replace section 2-1.04 with:

2-1.04 OUTREACH MEETING

The Department will conduct a prebid outreach meeting for this contract. The purpose of the outreach meeting is to discuss working in the San Luis Rey River, constructing the new sewer line, limited construction activities at the existing SDCWA Aqueducts, permits for this project, construction of mitigation sites and temporary haul bridge, and questions by the bidders.

The meeting is scheduled for 1300 on May 15, 2014, in Building 1, Room 125 "Garcia Room", at 4050 Taylor St, San Diego, CA.

Add to section 2-1.06B:

The Department makes the following supplemental project information available:

Supplemental Project Information

Means	Description
Included in the <i>Information Handout</i>	<ol style="list-style-type: none"> 1. California Department of Fish and Wildlife - 1602 Streambed Alteration Agreement; Dated June 6, 2013 2. United States Fish And Wildlife Service - Biological Opinion; Dated Sept. 22, 2011 3. United States Fish And Wildlife Service - Biological Opinion Amendment No. 1; Dated Nov. 29, 2011 4. United States Fish And Wildlife Service - Biological Opinion Amendment No. 2; Dated July 12, 2013 5. United States Department of Army, Corps of Engineers - 404 Permit; dated Dec. 23, 2013 6. California Regional Water Quality Control Board - Order No. R9-2008-0002, NPDES No. CAG919002, Dated January 21, 2014 7. California Regional Water Quality Control Board - 401 Certification No. R9-2013-0035; Dated July 19, 2013 8. San Luis Rey river Missive, Dated December 16, 2013 9. Live Oak Creek Missive, Dated December 16, 2013 10. District 11, Materials Information Brochure, 11-SD-PM 12.1/R17.7, Dated March 20, 2012 11. Seismic Design Recommendations, Dated Sept. 10, 2012 12. Foundation Report for San Diego County Water Authority Pipeline OC, Dated October 16, 2012 13. Foundation Report for Wild Animal Crossing No. 1, Dated November 14, 2012 14. Foundation Report for Wild Animal Crossing No. 2, Dated November 14, 2012 15. Foundation Report for Wild Animal Crossing No. 3, Dated November 14, 2012 16. Foundation Report for Wild Animal Crossing No. 4, Dated November 14, 2012 17. Foundation Report for Wild Animal Crossing No. 6, Dated November 14, 2012 18. Foundation Report for Live Oak Creek Bridge, Dated Dec. 13, 2012 19. Underground Classification Number: C051-073-14T, Dated October 17, 2013 20. Approved Materials List, Rainbow Municipal Water District 21. Water Supply for Highway 76 East Phase Construction; Dated September 10, 2012 22. Geotechnical Design Report Volume I 23. Geotechnical Design Report Volume II 24. Geotechnical Design Report Volume III 25. Battery Back-Up System Power Connection Diagrams
Available as specified in the <i>Standard Specifications</i>	<ol style="list-style-type: none"> 1. Bridge as-built drawings 2. Cross sections
Available for inspection at the Transportation Laboratory	<ol style="list-style-type: none"> 1. Core samples

Replace in section 2-1.44 with:

2-1.44 ESCROW OF BID DOCUMENTATION

Escrowed bid documentation must contain all documents, including calculations, used to compile the bid submittal. Clearly itemize your estimated costs of performing the work. Calculations must be complete and detailed enough to allow for an in-depth analysis of your bid. These are the only documents that will be accepted from you regarding preparation of the bid for use in resolution of disputes.

An authorized representative from each of the 1st, 2nd, and 3rd apparent low bidders must submit bid documentation for escrow.

Submit the name of the person authorized to deliver the documentation , to the Duty Senior before the close of business on the first Monday following bid opening.

The authorized person must submit documentation to the Duty Senior for escrow on the first Tuesday after bid opening between the hours of 1:00 p.m. and 2:00 p.m.

Submit bid documentation to the Department at the following location:

DISTRICT 11 CONSTRUCTION DUTY SENIOR
4050 Taylor Street
San Diego, CA 92110

TELEPHONE NUMBER (619) 688-6635
FAX NUMBER (619) 688-6988
E-MAIL Duty Senior District11 Duty Senior@dot.ca.gov

If notified, the 4th and subsequent apparent low bidders must present bid documentation for escrow.

Nothing in the escrowed documentation is to be construed to change or modify the terms or conditions of the contract.

The Department will not use escrowed bid documentation for preaward evaluation of your anticipated methods of construction or to assess your qualifications for performing the work.

Failure to submit the actual and complete bid documentation as specified herein within the time specified is cause for rejection of the bid.

Bid documentation for escrow must include:

1. Quantity takeoffs.
2. Rate schedules for the direct costs and the time- and nontime-related indirect costs for:
 - 2.1. Labor (by craft).
 - 2.2. Plant and equipment ownership and operation.
 - 2.3. Permanent and expendable materials, insurance, and subcontracted work.
3. Estimated construction schedules, including sequence and duration, and development of production rates.
4. Quotations, terms, and limitations of quotes and subcontracts related to subcontractors, manufacturers, and suppliers.
5. Estimates of field and home office overhead.
6. Estimated contingency and profit for each bid item of work.
7. Names of the persons responsible for preparing the bidder's estimate and other reports, calculations, assumptions, and supplemental information used by the bidder to arrive at the estimate submitted with the Bid book.
8. Bid documentation for each subcontractor, manufacturer, and supplier whose subcontract or purchase orders exceed or are expected to exceed \$250,000.00. Bid documentation for other subcontractors, manufacturers, and suppliers may be submitted, if required by the bidder, or requested by the subcontractor, manufacturer, or supplier.

If the bidder is a joint venture, the bid documentation must include the joint venture agreement, the joint venture estimate comparison, and final reconciliation of the joint venture bid.

The bid documentation of a subcontractor, manufacturer, or supplier must conform to the same requirements as the bidder's documentation.

The Department provides copies of the verified Bid books submitted by the 1st, 2nd, and 3rd low bidders to the respective bidders for inclusion in the bid documentation to be escrowed.

Bid documentation must be submitted as a paper copy in a sealed container, clearly marked with the bidder's name, date of submittal, contract number, and the words, "Bid Documentation for Escrow."

Signing the bid form certifies that you have examined the contents and have submitted all documents used in preparation of the bid submittal for escrow.

Subcontracts and purchase orders not executed or entered into at the time of bid must be submitted for inclusion in the escrowed documentation within 14 days of execution of the subcontract or purchase order.

To substitute a subcontractor, manufacturer, or supplier you must submit replacement bid documentation for review, approval, and escrow before authorization of the substitution will be granted.

The authorized representatives of the low bidder and the Department will evaluate the apparent low bidder's documents for escrow for legibility and to ensure authenticity.

Upon request, the bid documentation of a subcontractor, manufacturer, or supplier will be evaluated only by the subcontractor, manufacturer, or supplier and the Department and must be placed in a separate container within the bidder's container. The request from the subcontractor, manufacturer, or supplier must be included with the bid documentation.

Evaluation of subcontractors', manufacturers', and suppliers' bid documentation will be accomplished in the same manner as for the bidder's bid documentation.

Evaluation of bid documentation will not include review or constitute approval of:

1. Proposed construction methods
2. Estimating assumptions
3. Interpretation of the contract.

Acceptance or rejection of the bid documentation by the Department will be completed within 48 hours from the time the bid documentation is submitted by the low bidder.

Once the documentation has been evaluated and deemed to be legible and authentic it will be inventoried and escrowed.

The evaluation will not alter any conditions or terms of the contract.

At the completion of the evaluation, the bid documentation will be sealed and jointly deposited at an agreed commercial business in San Diego, CA.

Bid documentation submitted by the second and third apparent low bidders will be jointly deposited at an agreed commercial business in San Diego, CA.

If the apparent low bid is withdrawn or rejected, the bid documentation of the next low bidder will be evaluated and inventoried in the manner specified above, then sealed and deposited again in escrow.

Upon execution of the contract or rejection of all bids, the bid documentation will be returned to the unsuccessful bidders.

Components of the escrowed bid documentation may be examined by your designated representatives and the Department, at any time deemed necessary by either you or the Department or to assist in the negotiation of price adjustments and change orders, or to assist in the potential resolution or in the settlement of claims or disputes.

The joint examination must be performed within 15 days of receipt of a written request to do so by either party. Refusal by you to participate in the joint examination of escrowed bid documentation will be considered as a failure by you to exhaust administrative claim remedies with respect to the particular protest, notice of potential claim, or claim. In addition, this refusal by you constitutes a bar to future arbitration with respect to the protest, potential claim, or claim as provided by Pub Cont Code § 10240.2.

If requested by a Dispute Resolution Advisor or Dispute Resolution Board, the escrowed bid documentation may be used to assist the Advisor or Board in its recommendations.

The bid documentation submitted by the bidder is, and shall remain, the property of the bidder, and is subject to only joint review by the Department and the bidder.

If a subcontractor, manufacturer, or supplier requests, its bid documentation shall be subject to only joint examination by the subcontractor, supplier, or manufacturer and the Department unless it involves a dispute or claim against the Department.

The Department stipulates and expressly acknowledges that the submitted bid documentation constitutes trade secrets and will not be deemed public records. This acknowledgment is based on the Department's express understanding that the information contained in the bid documentation is not known outside the bidder's business, is known only to a limited extent and only by a limited number of employees of the bidder, is safeguarded while in the bidder's possession, is extremely valuable to the bidder and could be extremely valuable to the bidder's competitors by virtue of it reflecting the bidder's contemplated techniques of construction.

The Department acknowledges that the bid documentation includes a compilation of information used in the bidder's business, intended to give the bidder an opportunity to obtain an advantage over competitors who do not know of or use the contents of the documentation.

The Department agrees to safeguard the bid documentation, and all information contained therein, against disclosure, including disclosure of subcontractor bid documentation to you and other subcontractors, to the fullest extent permitted by law.

In the event of arbitration or litigation, the bid documentation shall be subject to discovery, and the Department assumes no responsibility for safeguarding the bid documentation unless you have obtained an appropriate protective order issued by the arbitrator or the court.

Bid documentation will be held in escrow until the Contract has been completed, the ultimate resolution of all disputes and claims has been achieved, and receipt of final payment has been accepted by you. The escrowed bid documentation will then be released from escrow.

The Department pays for the direct cost of depositing the bid documentation in escrow at the agreed commercial business.

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4 SCOPE OF WORK

Replace the 1st paragraph in section 4-1.07A with:

A committee has been established by the Department to review value engineering change proposals.

The committee is composed of civil engineers registered in the state as well as Management of the District Office.

Replace the 2nd paragraph in section 4-1.07B with:

Before preparing the VECP, meet with the Engineer and if you request by the Committee 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 proposals merit
7. Review times required by the Department and other agencies

Add to the list in the 2nd paragraph of section 4-1.07B:

8. Overall construction duration
9. Overall reduction in project risks

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5 CONTROL OF WORK

Add to section 5-1.09A:

The Department encourages the project team to exhaust the use of partnering in dispute resolution before engagement of an objective third party.

For certain disputes, a 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 DRB referral time following the Engineer's response to a *Supplemental Potential Claim Record*.

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 5-1.43.

Add to section 5-1.20A:

During the progress of the work under this Contract, work under the following contracts may be in progress at or near the job site of this Contract:

Coincident or Adjacent Contracts

Contract no.	County–Route–Post Mile	Location	Type of work
11-257144	SD-76-R16.7/R17.7	San Diego near Bonsal and Fallbrook on SR 76 and I-15	To modify and widen interchange
11-080104	SD-76-R7.3/13. 1	San Diego County near Oceanside	To construct four Lane Highway
11-13-6UK-0317	SD-76-17.69/R18.16	San Diego County near Horse Ranch Creek	Install water line
11-14-NLM-0193	SD-76-14.7/16.9	San Diego County near Monserate Hill	Morrison Mitigation Site

Add to section 5-1.23B(2):

For submittals to OSD Documents Unit, submit drawings and calculation sheets electronically in PDF format with at least 300 dpi resolution. You must have an email account and the following software on your computer with internet connection:

1. Operating system must be either:
 - 1.1. Windows XP
 - 1.2. Windows Vista
 - 1.3. Windows 7
2. Internet browser must be either:
 - 2.1. Chrome
 - 2.2. Internet Explorer 7 or newer
 - 2.3. Mozilla Firefox 3.0 or newer

The Department provides 60 minutes of internet based training on use of the internet based electronic submittal service within 30 days of your request. Upon completion of training, the Department provides accounts and user identification to your assigned representatives.

Additional training is provided if requested.

After completion of training, if you have questions about using the website to make a submittal, contact the Department at (916) 227-8497 or jeff.sims@dot.ca.gov.

Submit using the following basic instructions:

1. Open your internet browser and go to <https://app.attolist.com>.
2. Enter your username and password. Your username is always your e-mail address.
3. Select the Log In button.
4. If you are logging in for the first time, you will be prompted to fill out your profile information. After the profile is filled out, you will be directed to your All Projects page. If you have logged in before, you will be directed to the All Projects page.
5. On the All Projects page, expand the project in question by selecting the plus on the circular icon to the left of the project name.
6. To access the Submittals Module, select the Submittals hyperlink, located beneath the Construction Administration section.
7. Select the Add Submittal button from the top right of the interface.
8. The system will bring up a Submittal form; fill it out as follows:
 - 8.1. "Add a New Submittal" Section:
 - 8.1.1. Select the Select Number from Register hyperlink and pick the specification section from the register. The system will fill out the Specification Section, Sequential Number, Revision Number and Submittal Title for you. If the project does not have a submittal register, manually fill out the Specification Section and Submittal Title fields; the system will fill out the Sequential Number and Revision Number for you.
 - 8.1.2. Select the number of copies. In most cases, the default "N/A – PDF" is appropriate. If you are sending actual copies (such as samples or other physical items), select the number of copies. The software will automatically fill out today's date for the date received/sent and it will automatically populate the due date.
 - 8.1.3. Select the submittal type. The Trades/Disciplines will automatically fill out based on the submittal register, if they were provided. If they were not provided or if the project does not have a submittal register, manually select the trades/disciplines.

- 8.1.4. Select the correct Category if the project has them. Categories are generally used for different phases or structures within a larger project. Multiple Categories may be selected, if appropriate.
- 8.1.5. Select whether or not the item is a substitution. The Subcontractor/Manufacturer field and the Contractor Transmittal Number field are to be used at the project administrator's discretion.
- 8.2. "Review Comments" Section: If you are sending actual copies in step 8.1.2, enter the courier or other delivery information.
- 8.3. "Add Attachments" Section:
 - 8.3.1. Select the Choose File button(s) to Upload the pdf(s) of the submittal documentation.
 - 8.3.2. Give each item a title.
- 8.4. "Submittal Register" Section: It is not necessary to adjust this section.
- 8.5. "Notify Design Lead" Section: Click Send to submit to the OSD Documents Unit. The OSD Documents Unit will be notified of the submittal's existence.

If submittal of more than 1 copy or set of shop drawings or calculations is specified, submit only 1 electronic copy.

Upon review completion, the Department returns 1 electronic copy that shows the authorized date.

The specifications for paper weight in section 5-1.23B(2) do not apply to electronic submittals.

Add to section 5-1.26:

5-1.26A Finished Grade Information

The department delivers finished grade information to you for use in constructing the roadway excavation (Type C).

Submit your request for Department-furnished finished grade information 7 days prior to grading the roadway excavation (Type C).

The information will be delivered in the following formats:

1. Extensible Markup Language (Land XML)
2. American Standard Code for Information Interchange (ASCII)

The units will be in U.S Survey Feet.

Replace section 5-1.35 with CONTRACTOR PROHIBITED ACCESS AREA

5-1.35 CONTRACTOR PROHIBITED ACCESS AREA

5-1.35A General

Section 5-1.35 includes specifications for contractor prohibited access area requirements.

At the contractor prohibited access area shown:

1. Do not enter the area at existing grade unless authorized. You may enter the area via bridge.
2. If the area is breached, immediately:
 - 2.1. Secure the area and stop all operations within 60 feet of the boundary
 - 2.2. Notify the Engineer

5-1.35B Materials

Not Used

5-1.35C Construction

Not Used

5-1.35D Payment

Not Used

Add to section 5-1.36D:

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

Utility Relocation and Date of the Relocation

Utility	Location	Date
Relocate AT&T overhead telephone lines and poles	On SR 76 "A" Line from station 177+60 to 195+00	06/02/14
Relocate SDG&E overhead electrical lines and poles	On SR 76 "A" Line from station 136+50 to 153+00 and 175+50 to 195+50	06/02/14
Relocate SDG&E underground electrical lines	On SR 76 "A" Line from station 195+00 to 196+50	06/02/14

Contractor Arranged Time for Utility Relocation

Installation of the utilities shown in the following table requires coordination with your activities. Make the necessary arrangements with the utility company through the Engineer and submit a schedule:

1. Verified by a representative of the utility company
2. Allowing the time shown for notifying the utility owner and time to complete the work

The duration of the work in the schedule must equal or exceed the number of Notification Days (Utility N days) and Working Days (Utility W days) for the utility owner to complete their work.

Notification Days is the minimum number of calendar days written notice the Engineer provides the owner that the site will be ready for utility work.

Utility Working Days is the number of working days the Engineer provides the owner for utility work.

Type of Utility	Utility Work Description	Utility Owner & Address	Location of Utility	Utility N Days	Utility W Days
Lower existing underground cable	Relocation	AT&T 7337 Trade Street, #5686 San Diego, CA 92121 (858) 886-1901	Old Hwy 395 "FL-A" Line Sta 2256+30 and 2263+40	30	45
Relocate overhead telephone lines	Relocation	AT&T 7337 Trade Street, #5686 San Diego, CA 92121 (858) 886-1901	On SR 76 "A" Line from Sta 96+30 to 98+50 and 275+50	30	45
Relocate overhead telecommunication lines	Relocation	Cox Communications 5159 Federal Blvd San Diego, CA 92105	On SR 76 "A" Line from Sta 96+30 to 98+50	30	45
Lower underground fiber optics	Relocation	LEVEL 3 1025 El Dorado Blvd Broomfield, CO 20021 (858) 688-7007	Old Hwy 395 "FL-A" Line Sta 2255+50 - 2266+00	30	30
Relocate electrical overhead lines and poles	Relocation	SDG&E 8315 Century Park Court Suite 210 San Diego, CA 92123 858-636-3980	On SR 76 "A" Line from Sta 96+30 to 98+50, 275+50, 292+50	60	30
Lower in place existing 4 inch gas line	Relocation	SDG&E 8315 Century Park Court Suite 210 San Diego, CA 92123 858-636-3980	On SR 76 "A" Line at Sta 106+30	60	30
Install temporary 3 inch gas line	Install	SDG&E 8315 Century Park Court Suite 210 San Diego, CA 92123 858-636-3980	On SR 76 "A" Line at Sta 124+00 to 127+50	60	30
Lower underground electrical	Relocation	SDG&E 8315 Century Park Court Suite 210 San Diego, CA 92123 858-636-3980	On Old Hwy 395 "FL- A" at Sta 2263+10 to 2263+70 Existing RTA	60	30
Lower underground TV	Relocation	Time Warner Cable 10450 Pacific Center Ct. San Diego, CA 92121 (858) 635-8402	Old Hwy 395 "FL-A" Line Sta 2256+30 and 2263+40	90	30

Utilities Requiring Coordination with Contractor's Construction Operation

Installation of the listed utility facilities will require coordination with your construction operations. Make the necessary arrangements with the utility company through the Engineer and submit a schedule:

1. Verified by a representative of the utility company
2. Allowing the time shown for notifying the utility owner and time to complete the work

The duration of the work in the schedule must equal or exceed the number of Notification Days (Utility N days) and Working Days (Utility W days) for the utility owner to complete their work:

Notification Days is the minimum number of calendar days written notice the Engineer provides the owner that the site will be ready for utility work.

Utility Working Days is the number of working days the Engineer provides the owner for utility work.

Type of Utility	Utility Work Description	Utility Owner & Address	Location of Utility	Utility N Days	Utility W Days
Remove cell tower	Removal	Crown Castle 4301 Hacienda Dr. Suite 410 Pleasanton, CA 94588 (408) 391-4884	Old Hwy 395 "FL-A" Line Sta 2261+50	30	45

Site Preparation by Contractor

Installation of the listed utility facilities will require listed site preparation operations be completed by you first.

Make the necessary arrangements with the utility company through the Engineer and submit a schedule:

1. Verified by a representative of the utility company
2. Allowing the time shown for notifying the utility owner and time to complete the work

The duration of the work in the schedule must equal or exceed the number of Notification Days (Utility N days) and Working Days (Utility W days) for the utility owner to complete their work.

Notification Days is the minimum number of calendar days written notice the Engineer provides the owner that the site will be ready for utility work.

Utility Working Days is the number of working days the Engineer provides the owner for utility work.

The Working Days begin when the site preparation requirements have been completed and required notification provided.

Site Preparation Type	Site Preparation Work
(A)	Grading cut & fill to sub grade
(B)	Paving

Utility Work by Owners

Site Preparation Type (by Contractor)	Type of Utility	Utility Owner & Address	Location of Utility	Utility Work Description	Utility N Days	Utility W Days
(A) Before Stage 2 (i) - 4	TV Pedestal	Time Warner Cable 10450 Pacific Center Ct. San Diego, CA 92121 (858) 635-8402	Old Hwy 395 "FL-A" Line Sta 2259+30	Relocation of pedestals	90	10
(A) After Stage 2 (i) - 3	TV Pedestal	Time Warner Cable 10450 Pacific Center Ct. San Diego, CA 92121 (858) 635-8402	Old Hwy 395 "FL-A" Line Sta 2260+50	Relocation of pedestals	90	10
(A) Prior to Stage 2 (i) - 1	TV Pedestal	Time Warner Cable 10450 Pacific Center Ct. San Diego, CA 92121 (858) 635-8402	Old Hwy 395 "FL-A" Line Sta 2265+40	Relocation of pedestals	90	10
(B) After Stage 2 (i) - 6	Underground fiber optics	LEVEL 3 1025 El Dorado Blvd Broomfield, CO 20021 (858) 688-7007	Old Hwy 395 "FL-A" Line Sta 2263+30	Adjust manhole to Grade	30	5
(B) After Stage 2D	Gas	SDG&E 8315 Century Park Court Suite 210 San Diego, CA 92123 858-636-3980	At Ramona Rd."RM" Line Sta 11+85 and 12+00	Adjust valve covers to grade	60	5
(B) After Stage 2C	Gas	SDG&E 8315 Century Park Court Suite 210 San Diego, CA 92123 858-636-3980	On SR 76 "A" Line at Sta 124+00 to 127+50	Install 4" gas line	60	30
(A) During Stage 1A	Overhead electrical lines and poles	SDG&E 8315 Century Park Court Suite 210 San Diego, CA 92123 858-636-3980	On SR 76 "A" Line from Sta 123+50 to 132+00	Final relocation of OH electrical lines and poles	60	30

(A) During Stage 2D	Overhead electrical lines and poles	SDG&E 8315 Century Park Court Suite 210 San Diego, CA 92123 858-636-3980	On SR 76 "A" Line from Sta 136+50 to 153+00	Final relocation of OH electrical lines and poles	60	30
(A) During Stage 2F	Overhead electrical lines and poles	SDG&E 8315 Century Park Court Suite 210 San Diego, CA 92123 858-636-3980	On SR 76 "A" Line from Sta 155+00 to 195+50	Final relocation of OH electrical lines and poles	60	80
(B) After Stage 2 (i) - 3	Electrical vault to be adjusted to grade	SDG&E 8315 Century Park Court Suite 210 San Diego, CA 92123 858-636-3980	On Old Hwy 395 "FL-A" Line Sta 2261+50	Adjust vault	60	30
(B) After Stage 2A	Electrical vault to be adjusted to grade	SDG&E 8315 Century Park Court Suite 210 San Diego, CA 92123 858-636-3980	On SR-76 "A" Line Sta 98+50	Adjust vault	60	30
(B) After Stage 2D	Electrical vault to be adjusted to grade	SDG&E 8315 Century Park Court Suite 210 San Diego, CA 92123 858-636-3980	On Ramona "RAM" Line Sta 12+00	Adjust vault	60	30
(A) During Stage 2 (i) - 4	Electric Car charging station	SDG&E 8315 Century Park Court Suite 210 San Diego, CA 92123 858-636-3980	In park and ride	Run wires thru conduits	60	30
(B) After Stage 2 (i) - 6	Manhole to be adjusted to grade.	AT&T 7337 Trade Street, #5686 San Diego, CA 92121 (858) 886-1901	Old Hwy 395 "FL-A" Line Sta 2260+50	Adjust manhole to grade	30	45
(A) After Stage 2 (i) - 4	Pedestals to be relocated	AT&T 7337 Trade Street, #5686 San Diego, CA 92121 (858) 886-1901	Old Hwy 395 "FL-A" Line Sta 2262+20, 2263+70, 2265+40	Relocate pedestals	30	45

(A) During Stage 2D	Overhead telephone lines	AT&T 7337 Trade Street, #5686 San Diego, CA 92121 (858) 886-1901	On SR 76 "A" Line from Sta 148+50 to 153+00	Final relocation of OH telephone lines	30	45
(A) During Stage 2F	Overhead telephone lines	AT&T 7337 Trade Street, #5686 San Diego, CA 92121 (858) 886-1901	On SR 76 "A" Line from Sta 175+50 to 195+50	Final relocation of OH telephone lines	30	45

6 CONTROL OF MATERIALS

Add to section 6-2.03:

The Department furnishes you with:

- Loop detector sensor units
- Piezo electric sensor
- Model 170 controller assembly, including controller unit, completely wired controller cabinet, and detector sensor units
- Model 2070 controller unit
- Components of battery backup system as follows:
 - Inverter/charger unit
 - Power transfer relay
 - Manually-operated bypass switch
 - Battery harness
 - Utility interconnect wires
 - Battery temperature probe
 - Relay contact wires

The Department furnishes you with completely wired controller cabinets with auxiliary equipment but without controller unit at the Caltrans Escondido Maintenance Station, 1780 W. Mission Avenue, Escondido, CA. At least 48 hours before you pick up the materials, inform the Engineer of what you will pick up and when you will pick it up.

AA

7 LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

Replace section 7-1.02K(6)(j)(iii) with:

7-1.02K(6)(j)(iii) Earth Material Containing Lead

Section 7-1.02K(6)(j)(iii) includes specifications for handling, removing, and disposing of earth material containing lead.

Submit a lead compliance plan.

Lead is present in earth material on the job site. The average lead concentrations are below 1,000 mg/kg total lead and below 5 mg/L soluble lead. The material on the job site:

1. Is not a hazardous waste
2. Does not require disposal at a permitted landfill or solid waste disposal facility

Do not start other job site activities until all the submittals from the above list are authorized or accepted and the following information is received by the Engineer:

1. *Notice of Materials To Be Used* form.
2. 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.
3. 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.
4. 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 job site activities before the 55th day after Contract approval if you:

1. Obtain specified authorization or acceptance for each submittal before the 55th day
2. Receive authorization to start

Submit a notice 72 hours before starting job site activities. If the project has more than 1 location of work, submit a separate notice for each location.

AA

9 PAYMENT

Add to section 9-1.16C:

The following items are eligible for progress payment even if they are not incorporated into the work:

1. Prestressing Steel
2. PC/PS Girder
3. Joint Seals
4. Bar Reinforcing Steel
5. Steel Casing
6. Tubular Hand Railing
7. Steel Sheet Piling
8. Sign Panels
9. Timber Retaining Wall
10. Culvert Pipe
11. Underdrain Pipe
12. Miscellaneous Drainage Facilities
13. Fences and Gates
14. Miscellaneous Iron and Steel
15. Sewer Manhole
16. Sewer Laterals,
17. Plastic Pipe (Irrigation Systems)
18. Sprinklers
19. Remote Control Valves
20. Irrigation Controllers
21. Irrigation Controller Enclosure Cabinets
22. Water Valve
23. Fire Hydrant
24. Water Meter
25. Valves

Replace "Reserved" in section 10-1.03 of the RSS for section 10-1 with:

No entrance is allowed to the following parcels on SR 76 until the following date:

Parcel No	Owner	Address or Post Mile Date Available
34787	Miller	4580 Orange Hill Rd, Fallbrook, CA June 1 2014
34796	Vista Trust	4141 Pala Road, Fallbrook, CA September 1, 2014
34797	Kendall Land LP	4230 White Lilac Rd, Fallbrook, CA May 31, 2015
34798	San Diego County Water Authority	Post Mile 16.5 May 31, 2015
34799, 34991 & 34992	Pala Mesa Pac Prop	Post Mile 16.8, 17.1 & 17.1 June 1, 2014
34800	Raedeker	Post Mile 16.6 June 1, 2014

Closure of driveways for construction activity is allowed as shown in the following table:

DRIVEWAY LOCATION	ALLOWED CLOSURE	MAXIMUM DURATION (Night Time Closures are from 6:00 p.m. to 6:00 a.m.)	No. OF TIMES ALLOWED	SPECIAL RESTRICTIONS AND CONDITIONS
CDW	Stage 2D	2 Nights (Consecutive)	1	Access to the San Diego County Yard is to be available at all times.
P-1	Stage 2C	1 Night	1	
P-1	Stage 2D (Sewer)	2 Nights (Consecutive)	1	
Loc 1	Stage 2D (Indirect access available through adjacent property)	3 Months	1	
Loc 1	Stage 2E (Sewer)	2 Nights (Consecutive)	1	
Loc 2	Stage 2B	1 Week	1	No Sunday Closure.
Loc 2	Stage 2E (Sewer)	2 Nights (Consecutive)	1	

Loc 3	Stage 2B	1 Week	1	No Sunday Closure.
Loc 3	Stage 2E(Sewer)	2 Nights (Consecutive)	1	Locations 3 and 4 may not be closed at the same time.
Loc 4	Stage 2E	1 Night	1	Locations 3 and 4 may not be closed at the same time
Loc 4	Stage 2E (Sewer)	2 Nights (Consecutive)	1	
Loc 5	Stage 2B	1 Night	1	
Loc 5	Stage 2G (Sewer)	2 Nights (Consecutive)	1	
Loc 6	Stage 2B	1 Night	1	No construction and access maintained on Mondays and the 1st Tuesday of the month
Loc 6	Stage 2G (Sewer)	2 Nights (Consecutive)	1	
NDW4	Stage 4A (Indirect access available through adjacent property)	2 Weeks	1	

Loc 7	Stage 4A	1 Week	1	
Loc 8	Stage 4A	24 Hours	1	
Loc 9	Stage 4C	48 Hours	1	
Loc 9	Stage 4D (Sewer)	2 Nights (Consecutive)	1	
Loc 10	See Special Restriction and Conditions	See Special Restriction and Conditions		Use Traffic Chart for "OC" for guidance
SDW1	Stage 1A	1 Year	1	
SDW2	Stage 1A	1 Year	1	
SDW3, SDW5	Stage 1A	1 Year	1	
SDW4	No closures (Access maintained)			
SDW6A	Stage3B	1 Year	1	
SDW6, SDW7	No closures (One driveway to remain open)			
SDW8	No closures (Access maintained)			
SDW9	Stage 3A (Indirect available through adjacent property)	1 Year	1	
Loc 11	Stage 2I Phase 5 (Loc 13 to remain open)	1 Week	1	
Loc 12	Stage 2I Phase 4 (Alternative driveway to remain open)	1 Month	1	
Loc 13	Stage 2I Phase 4 (Loc 11 to remain open)	1 Month	1	

The legend for the type of project on construction project funding signs must read as follows:

HIGHWAY CONSTRUCTION

The legend for the types of funding on construction project funding signs must read as follows and in the following order:

FEDERAL HIGHWAY TRUST FUNDS

STATE HIGHWAY FUNDS

SANDAG TRANSNET FUNDS

The Engineer will provide the year of completion for the legend on construction project funding signs. Furnish and install a sign overlay for the year of completion within 10 working days of notification.

The size of the legend on construction project funding signs must be as described. Do not add any additional information unless authorized.

12-2.03 CONSTRUCTION

Install 2 Type 1 construction project funding signs and 2 TRANSNET funding signs on route 76 and install 2 Type 2 construction project funding signs on I-15 at the locations designated by the Engineer before starting major work activities visible to highway users.

When authorized, remove and dispose of construction project funding signs upon completion of the project.

12-2.04 PAYMENT

Not Used

Add section 12-3.08C:

If the dowels in concrete pavement or the capped stake in HMA or existing asphalt concrete are removed, fill the holes with mortar and place a 3 foot wide paving fabric as shown.

Add to section 12-3.12C:

Start displaying the message on the portable changeable message sign 30 minutes before closing the lane.

Place the portable changeable message sign in advance of the 1st warning sign for each:

1. Stationary lane closure
2. Off-ramp closure
3. Connector closure
4. Shoulder closure

For 5 days, starting on the day of signal activation, place 1 portable changeable message sign in each direction of travel and display the following message: "SIGNAL AHEAD -- PREPARE TO STOP."

Replace section 12-3.13 with:

12-3.13 IMPACT ATTENUATOR VEHICLE

12-3.13A General

12-3.13A(1) Summary

Section 12-3.13 includes specifications for protecting traffic and workers with an impact attenuator vehicle during moving lane closures and when placing and removing components of stationary lane closures, ramp closures, shoulder closures, or a combination.

Do not use an impact attenuator vehicle to place, remove, or place and remove components of a stationary traffic control system on a 2-lane, 2-way highway where the useable shoulder width is less than 10 feet unless authorized.

Impact attenuator vehicles must comply with the following test levels under National Cooperative Highway Research Program 350:

1. Test level 3 if the preconstruction posted speed limit is 50 mph or more
2. Test levels 2 or 3 if the preconstruction posted speed limit is 45 mph or less

Comply with the attenuator manufacturer's instructions for:

1. Support truck
2. Trailer-mounted operation
3. Truck-mounted operation

Flashing arrow signs must comply with section 12-3.03. You may use a portable changeable message sign instead of a flashing arrow sign. If a portable changeable message sign is used as a flashing arrow sign, it must comply with section 6F.56 "Arrow Panels" of the *California MUTCD*.

12-3.13A(2) Definitions

impact attenuator vehicle: A support truck that is towing a deployed attenuator mounted to a trailer or a support truck with a deployed attenuator that is mounted to the support truck.

12-3.13A(3) Submittals

Upon request, submit a certificate of compliance for each attenuator used on the project.

12-3.13A(4) Quality Control and Assurance

Do not start impact attenuator vehicle activities until authorized.

Before starting impact attenuator vehicle activities, conduct a preinstallation meeting with the Engineer, subcontractors, and other parties involved with traffic control to discuss the operation of the impact attenuator vehicle during moving lane closures and when placing and removing components of stationary traffic control systems.

Schedule the location, time, and date for the preinstallation meeting with all participants. Furnish the facility for the preinstallation meeting within 5 miles of the job site or at another location if authorized.

12-3.13B Materials

Attenuators must be a brand on the Authorized Material List for highway safety features.

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 or greater than 26,400 pounds.

For the Trinity MPS-350 truck-mounted attenuator, the support truck must not have a fuel tank mounted underneath within 10'-6" of the rear of the support truck.

Each impact attenuator vehicle must have:

1. Legal brake lights, taillights, sidelights, and turn signals
2. Inverted "V" chevron pattern placed across the entire rear of the attenuator composed of alternating 4-inch wide nonreflective black stripes and 4-inch wide yellow retroreflective stripes sloping at 45 degrees
3. Type II flashing arrow sign
4. Flashing or rotating amber light
5. Operable 2-way communication system for maintaining contact with workers

12-3.13C Construction

Except where prohibited, use an impact attenuator vehicle:

1. To follow behind equipment and workers who are placing and removing components of a stationary lane closure, ramp closure, shoulder closure, or any combination. Operate the flashing arrow sign in the arrow or caution mode during this activity, whichever applies. Follow at a distance that prevents intrusion into the workspace from passing traffic.
2. As a shadow vehicle in a moving lane closure.

After placing components of a stationary traffic control system you may place the impact attenuator vehicle in advance of the work area or at another authorized location to protect traffic and workers.

Secure objects, including equipment, tools, and ballast on impact attenuator vehicles to prevent loosening upon impact by an errant vehicle.

Do not use a damaged attenuator in the work. Replace any attenuator damaged from an impact during work activities at your expense.

12-3.13 Payment

Not Used

Add section 12-3.19

12-3.19 ALTERNATIVE TEMPORARY CRASH CUSHION SYSTEM

12-3.19A General

12-3.19A(1) Summary

This section includes specifications for installing and maintaining alternative temporary crash cushion system as shown under the manufacturer's installation instructions and these special provisions.

The allowable alternatives for temporary crash cushion must consist of one of the following National Cooperative Highway Research Program (NCHRP) Report 350, 1993, Test Level 3 devices.

12-3.19A(2) Submittals

Submit a certificate of compliance and a copy of the manufacturer's installation instructions for the alternative temporary crash cushion.

12-3.19B Materials

The alternative temporary crash cushion systems must be one of the following National Cooperative Highway Research Program (NCHRP) Report 350, 1993, Test Level 3 devices.

1. TYPE ADIEM-350 Manufactured by Trinity Industries, Inc., and must include the items detailed for crash cushion (Type ADIEM 350) shown on the manufacturer plans and installation instructions. You can obtain the crash cushion (Type ADIEM 350) from the supplier, C&W Construction Specialties, Inc., 2419 Palma Drive, Ventura, CA 93003, telephone (805) 642-0204, Fax (805) 642-5141.
2. The Smart Crash Cushion (SCI 100GM) is a non-gating, redirective impact attenuator crash cushion manufactured by SCI Products Inc. 2500 Production Drive, St. Charles, IL 60174-9081, telephone (800) 327-4417, fax (630) 377-9270. The SCI 100GM Crash Cushion system must include all items detailed on the manufacturer plans and installation instructions. The SCI 100GM crash cushion may be obtained from the distributor, D&M Traffic Services, 845 Reed Street, Danta Clara, CA 95050, telephone (408) 436-1127.
3. QUADGUARD CZ - Non-gating, redirective crash cushion manufactured by Energy Absorption, must include items detailed for QUADGUARD CZ shown on the manufacturer plans and installation instructions. The QUADGUARD CZ can be obtained from the distributor, National Trench Safety LLC, 1421 N. Baxter Street, Anaheim, CA 92608, telephone (714) 491-7393, fax (714) 491-7397.
4. SLED - SENTRY LONGITUDINAL ENERGY DISSIPATOR END TREATMENT manufactured by Traffix Devices, Inc., must include the items detailed for crash cushion (Type SLED) shown on the manufacturer plans and installation instructions. You can obtain the crash cushion (Type SLED) from the manufacturer, Traffix Devices, Inc., 160 Avenida La Plata, San Clemente, CA 92673 telephone (949) 361-9205.

12-3.19C Construction

The alternative temporary crash cushion must be installed in conformance with the manufacturer's installation instructions.

Concrete anchorage devices for attaching alternative temporary crash cushion to the base slab is limited to those provided by the manufacturer.

Concrete anchor slab when required must comply with section 51, except the strength is to be 4,000 psi at 28 days.

After installing the temporary crash cushion, dispose of surplus excavated material in a uniform manner along the adjacent roadway where designated by the Engineer.

12-3.19D Payment

Not Used

Add section 12-4.01 with:

Submit a notice of lane closure or detour that requires use of a county road 3 weeks in advance.

Add to section 12-4.02A:

For grinding and grooving operations, saw cutting concrete slabs, and installing loop detectors, closure of the adjacent traffic lane is not required if an impact attenuator vehicle is used as a shadow vehicle.

Designated holidays are shown in the following table:

Designated Holidays

Holiday	Date observed
New Year's Day	January 1st
Washington's Birthday	3rd Monday in February
Memorial Day	Last Monday in May
Independence Day	July 4th
Labor Day	1st Monday in September
Veterans Day	November 11th
Thanksgiving Day	4th Thursday in November
Christmas Day	December 25th

If a designated holiday falls on a Sunday, the following Monday is a designated holiday. If November 11th falls on a Saturday, the preceding Friday is a designated holiday.

For a one-way reversing traffic-control lane closure, traffic may be stopped in 1 direction for periods not to exceed 10 minutes. After each stoppage, all accumulated traffic for that direction must pass through the work zone before another stoppage is made.

Freeway closure charts are for the erection and removal of falsework, placement and removal of overhead sign structures, and other authorized work.

Add to the RSS for section 12-4.03C:

Submit a contingency plan for blasting.

Discuss the contingency plan with the Engineer at least 5 business days before starting the activity.

Replace the 5th paragraph of the RSS for section 12-4.03C with:

Submit revisions to a contingency plan at least 3 business days before starting the activity requiring a contingency plan. Allow 2 business days for review of the revised contingency plan.

Construction equipment must enter and leave the Vessels excavation site south of the San Luis Rey River by the temporary haul bridge.

Replace "Reserved" in section 12-4.04 with:

Lane Closure Restriction for Designated Holidays										
Thu	Fri	Sat	Sun	Mon	Tues	Wed	Thu	Fri	Sat	Sun
x	H xx	xx	xx							
x	xx	H xx	xx							
	x	xx	H xx	xx						
	x	xx	xx	H xx	xxx					
				x	H xx					
					x	H xx				
						x	H xx	xx	xx	xx

Legend:

	Refer to lane requirement charts
x	The full width of the traveled way must be open for use by traffic after 1200.
xx	The full width of the traveled way must be open for use by traffic.
xxx	The full width of the traveled way must be open for use by traffic until 0500.
H	Designated holiday

Replace "Reserved" in section 12-4.05D with:

Chart no. D1 Connector Lane Requirements																									
County: SD							Route/Direction: 15-NB							PM: R46.173											
Closure limits: NB 15 Conn. to Rte. 76																									
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
Mon-Thu	1	1	1	1	1															1	1	1	1	1	
Fri	1	1	1	1	1																				
Sat				1	1	1	1	1	1	1	1														
Sun				1	1	1	1	1	1	1	1									1	1	1	1	1	

Legend:

1	Provide at least 1 connector lane open in direction of travel
	No connector closure allowed, shoulders may be closed

REMARKS:

Chart no. D2 Connector Lane Requirements																									
County: SD							Route/Direction: 15-SB							PM: R46.834											
Closure limits: 15 SB Conn. to Rte. 76																									
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
Mon-Thu	1	1	1	1	1															1	1	1	1	1	
Fri	1	1	1	1	1																				
Sat				1	1	1	1	1	1	1	1														
Sun				1	1	1	1	1	1	1	1									1	1	1	1	1	
Legend:																									
<input type="checkbox"/> 1 Provide at least 1 connector lane open in direction of travel <input type="checkbox"/> No connector closure allowed, shoulders may be closed																									
REMARKS:																									

Chart no. D3 Connector Lane Requirements																									
County: SD							Route/Direction: 76-EB							PM: R17.180											
Closure limits: EB 76 Conn. to SB 15																									
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
Mon-Thu	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Fri	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Sat	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Sun	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Legend:																									
<input type="checkbox"/> S Shoulder closure allowed																									
REMARKS:																									

Chart no. D4 Connector Lane Requirements																									
County: SD							Route/Direction: 76/EB							PM: R17.416											
Closure limits: EB 76 Conn. to NB 15																									
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
Mon-Thu	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Fri	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Sat	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Sun	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Legend: S Shoulder closure allowed																									
REMARKS:																									

Chart no. D5 Connector Lane Requirements																									
County: SD							Route/Direction: 76-WB							PM: R17.418											
Closure limits: WB 76 Conn. to NB 15																									
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
Mon-Thu	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Fri	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Sat	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Sun	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Legend: S Shoulder closure allowed																									
REMARKS:																									

Chart no. D6 Connector Lane Requirements																									
County: SD										Route/Direction: 76-WB										PM: R17.183					
Closure limits: WB 76 Conn. to SB 15																									
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
Mon-Thu	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Fri	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Sat	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Sun	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Legend:																									
<input type="checkbox"/> S Shoulder closure allowed																									
REMARKS:																									

Replace "Reserved" in section 12-4.05F with:

Chart no. F1 Conventional Highway Lane Requirements																										
County: SD										Route/Direction: 76 – EB										PM: R12.00 – R12.77						
Closure limits: Olive Hill Rd. to 0.30 Mi. east of S. Mission Rd.																										
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	
Mon-Thu		1	1	1	1	1																	1	1	1	1
Fri		1	1	1	1	1																				
Sat					1	1	1	1	1																	
Sun					1	1	1	1	1	1	1												1	1	1	1
Legend:																										
<input type="checkbox"/> 1 Provide at least 1 through traffic lane open in direction of travel																										
<input type="checkbox"/> No lane closure allowed, shoulders may be closed																										
REMARKS:																										

Chart no. F2 Conventional Highway Lane Requirements																								
County: SD						Route/Direction: 76 – WB						PM: R12.57 – R12.00												
Closure limits: 0.10 Mi. east of S. Mission Rd. to Olive Hill Rd.																								
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
Mon-Thu	1	1	1	1	1															1	1	1	1	1
Fri	1	1	1	1	1																			
Sat																								
Sun				1	1	1	1	1	1													1	1	1
Legend:																								
<input type="checkbox"/> 1 Provide at least 1 through traffic lane open in direction of travel <input type="checkbox"/> No lane closure allowed, shoulders may be closed																								
REMARKS:																								

Chart no. F3 Conventional Highway Lane Requirements																									
County: SD						Route/Direction: 76 – EB						PM: R16.95 – 17.75													
Closure limits: 0.35 Mi. W. of Jct. 15 to Horse Ranch Cr.																									
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
Mon-Thu	1	1	1	1	1															1	1	1	1	1	
Fri	1	1	1	1	1																				
Sat				1	1	1	1	1	1	1	1														
Sun				1	1	1	1	1	1	1	1									1	1	1	1	1	
Legend:																									
<input type="checkbox"/> 1 Provide at least 1 through traffic lane open in direction of travel <input type="checkbox"/> Work allowed within the highway where shoulder or lane closure is not required																									
REMARKS:																									

**Chart no. F4
Conventional Highway Lane Requirements**

County: SD	Route/Direction: 76 – WB	PM: 17.75 – R16.95
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Closure limits: Horse Ranch Cr. to 0.35 Mi. W. of Jct. 15

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
Mon-Thu		1	1	1	1	1															1	1	1	1	1
Fri		1	1	1	1	1																			
Sat				1	1	1	1	1	1	1															
Sun				1	1	1	1	1	1	1												1	1	1	1

Legend:

1 Provide at least 1 through traffic lane open in direction of travel

No lane closure allowed, shoulders may be closed

REMARKS:

**Chart no. F5
Conventional Highway Lane Requirements**

County: SD					Route/Direction: 76 – EB-WB					PM: 12.57 – R16.95															
Closure limits: 0.10 mi. E. of Mission Rd. to 0.35 Mi. W. of Jct. 15																									
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
Mon-Thu	R	R	R	R	R																R	R	R	R	
Fri	R	R	R	R	R																				
Sat																									
Sun																							R	R	R

Legend:

- R Provide at least 1 through traffic lane, not less than 10 feet in width, for use by both directions of travel
- Work allowed within the highway where shoulder or lane closure is not required

REMARKS:

All side streets within the Post Mile limits of this closure may be closed.
Allow Local Traffic only.

NOTE: When Reverse Traffic Control is used:

1. Close one traffic lane and stop public traffic for periods not to exceed (10) ten minutes.
2. Maximum length of one-way control shall be 0.25 mi.

Replace "Reserved" in section 12-4.05G with:

Chart no. G1 Complete Conventional Highway Closure Hours																									
County: SD							Route/Direction: 76 EB-WB							PM: 12.00 – 16.78											
Closure limits: Olive Hill Rd. to Oak Creek																									
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
Mon-Thu	C	C	C	C	C	C	C													C	C	C	C	C	
Fri	C	C	C	C	C	C	C																		
Sat																									
Sun																				C	C	C	C	C	
<p>Legend:</p> <p><input type="checkbox"/> C Conventional highway may be closed Intermittently.</p> <p><input type="checkbox"/> No complete conventional highway closure is allowed, except as shown in chart no. G2</p>																									
<p>REMARKS:</p> <ol style="list-style-type: none"> 1. This chart to be used for dirt hauls across the highway only. 2. Allow haul trucks to pass. Stop public traffic for periods not to exceed (1) one minutes per closure at a maximum of (10) ten closures per hour. Queued traffic must be cleared prior to stopping traffic again. 3. The Engineer will coordinate with the Contractor when the use of Cozeep during this operation is required. <p>When the Highway is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76, at locations at the discretion of the Construction personnel warning the traffic of the closure ahead.</p>																									

**Chart no. G2
Complete Conventional Highway Closure Hours**

County: SD	Route/Direction: 76 EB-WB	PM: 12.00 – 16.78
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Closure limits: Olive Hill Rd. to Oak Creek

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
Mon-Thu								C	C	C	C	C	C	C	C	C	C	C	C						
Fri								C	C	C	C	C	C	C	C	C	C	C	C						
Sat																									
Sun																									

Legend:

- C Conventional highway may be closed Intermittently.
- No complete conventional highway closure is allowed, except as shown in chart no. G1

REMARKS:

4. This chart to be used for dirt hauls across the highway only.
5. Allow haul trucks to pass. Stop public traffic for periods not to exceed (1) one minute per closure at a maximum of (5) five closures per hour. Queued traffic must be cleared prior to stopping traffic again.
6. The Engineer will coordinate with the Contractor when the use of Cozeep during this operation is required.

When the Highway is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76, at locations at the discretion of the Construction personnel warning the traffic of the closure ahead.

**Replace section 12-4.05H with:
12-4.05H City Street Closures**

Chart no. H1 City Street Requirements and Hours of Work																									
County: SD					Route/Direction: NB-SB / Sweetgrass Ln.										PM:										
Closure limits: At Rte. 76																									
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
Mon-Thu	X	X	X	X	X																		X	X	X
Fri	X	X	X	X	X																				
Sat																									
Sun																							X	X	X
<p>Legend:</p> <p><input checked="" type="checkbox"/> Street may be closed</p> <p><input type="checkbox"/> No lane closure allowed, shoulders may be closed</p>																									
<p>REMARKS:</p> <p>Allow access for local traffic only.</p> <p>When the Road is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76 warning the traffic of the closure ahead.</p>																									

**Chart no. H2
City Street Requirements and Hours of Work**

County: SD	Route/Direction: NB-SB / Sweetgrass Ln.	PM:
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Closure limits: At Rte. 76

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
Wed-Thu	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fri	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sat	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sun																									

Legend:

- Street may be closed
- No lane closure allowed, shoulders may be closed

REMARKS:

Allow access for local traffic only.
 This chart to be used for a maximum of two (2) consecutive days only.
 This closure cannot be used on Sundays and Tuesdays.
 When the Road is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76 warning the traffic of the closure ahead.

**Chart no. H3
City Street Requirements and Hours of Work**

County: SD	Route/Direction: NB-SB / Ramona Dr.	PM:
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Closure limits: At Rte. 76

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
Mon-Thu	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fri	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sat																									
Sun																									

Legend:

Street may be closed

No lane closure allowed, shoulders may be closed

REMARKS:

No other closure that conflicts with or shares any elements of the following detour will be permitted. This chart to be used for a maximum of five (5) days only.

Detour NB Ramona Dr.

Detour NB Ramona Dr. traffic via Rte. 76/Pala to Co. Hwy. S.13 (S. Mission Rd.), thence northerly on Co. Hwy. S.13 (S. Mission Rd.) to La Canada Rd., thence easterly on La Canada Rd. to Hillrise Rd., thence easterly on Hillrise Rd. to Ramona Dr.

Detour SB Ramona Dr.

Detour SB Ramona Dr. traffic via southerly on Ramona Dr. to Hillrise Rd., thence westerly on Hillrise Rd. to La Canada Rd., thence westerly on La Canada Rd. to Co. Hwy. S.13 (S. Mission Rd.), thence southerly on Co. Hwy. S.13 (S. Mission Rd.) to Rte. 76/Pala Rd.

When the Road is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76 warning the traffic of the closure ahead.

**Chart no. H4
City Street Requirements and Hours of Work**

County: SD	Route/Direction: NB-SB Ramona Dr.	PM:
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Closure limits: At Rte. 76

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
Mon-Thu	X	X	X	X	X																	X	X	X	
Fri	X	X	X	X	X																				
Sat																									
Sun																						X	X	X	

Legend:

- Street may be closed
- No lane closure allowed, shoulders may be closed

REMARKS:

No other closure that conflicts with or shares any elements of the following detour will be permitted.

Detour NB Ramona Dr.

Detour NB Ramona Dr. traffic via Rte. 76/Pala to S. Mission Rd. (Co. Hwy S 13), thence northerly on S. Mission Rd. (Co. Hwy S 13), to La Canada Rd., thence easterly on La Canada Rd. to Hillrise Rd., thence easterly on Hillrise Rd. to Ramona Dr.

Detour SB Ramona Dr.

Detour SB Ramona Dr. traffic via southerly on Ramona Dr. to Hillrise Rd., thence westerly on Hillrise Rd. to La Canada Rd., thence westerly on La Canada Rd. to S. Mission Rd. (Co. Hwy S 13), thence southerly on S. Mission Rd. (Co. Hwy S 13), to Rte. 76/Pala Rd.

When the Road is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76 warning the traffic of the closure ahead.

**Chart no. H5
City Street Requirements and Hours of Work**

County: SD	Route/Direction: NB-SB Calle de la Vuelta	PM:
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Closure limits: At Rte. 76

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
Mon-Thu	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fri																									
Sat																									
Sun																									

Legend:
 Street may be closed
 No lane closure allowed, shoulders may be closed

REMARKS:
 Allow access for local traffic only.
 This chart to be used for a maximum of two (2) consecutive days only.
 When the Road is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76 warning the traffic of the closure ahead.

**Chart no. H6
Complete City Street Closure Hours**

County: SD	Route/Direction: NB-SB / Via Monserate	PM:
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Closure limits: At Rte. 76

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
Mon-Thu	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fri	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sat	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sun	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Legend:

X Street may be closed

REMARKS:

No other closure that conflicts with or shares any elements of the following detour will be permitted.

This chart to be used for a maximum of two (2) times, each time for a period of two (2) weeks only.

Detour NB Via Monserate

Detour NB Via Monserate traffic via Rte. 76/Pala to Ramona Dr., thence northerly on Ramona Dr. to S. Via Monserate.

Detour SB Via Monserate

Detour SB Via Monserate traffic via southerly on Via Monserate to Ramona Dr. to thence southerly on Ramona Dr. to Rte. 76/Pala Rd.

When the Road is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76 warning the traffic of the closure ahead.

Chart no. H7																									
City Street Requirements and Hours of Work																									
County: SD							Route/Direction: NB-SB / Via Monserate										PM:								
Closure limits: At Rte. 76																									
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
Mon-Thu	X	X	X	X	X																		X	X	X
Fri	X	X	X	X	X																				
Sat																									
Sun																							X	X	X
Legend:																									
<input checked="" type="checkbox"/> Street may be closed <input type="checkbox"/> No lane closure allowed, shoulders may be closed																									
REMARKS:																									
No other closure that conflicts with or shares any elements of the following detour will be permitted.																									
Detour NB Via Monserate																									
Detour NB Via Monserate traffic via Rte. 76/Pala to Ramona Dr., thence northerly on Ramona Dr. to S. Via Monserate.																									
Detour SB Via Monserate																									
Detour SB Via Monserate traffic via southerly on Via Monserate to Ramona Dr. to thence southerly on Ramona Dr. to Rte. 76/Pala Rd.																									
When the Road is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76 warning the traffic of the closure ahead.																									

**Chart no. H8
Complete City Street Closure Hours**

County: SD	Route/Direction: NB-SB Flowerwood Ln.	PM:
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Closure limits: At Rte. 76

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
Mon-Thu	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fri	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sat	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sun	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Legend:

X Street may be closed

REMARKS:

No other closure that conflicts with or shares any elements of the following detour will be permitted.

This chart to be used for a maximum of four (4) months only.

This closure shall be used Only after construction of the new alignment of EB-WB 76 and traffic is switched over to the new Roadway alignment.

Detour NB Flowerwood Ln.

Detour NB Flowerwood Ln. traffic via Rte. 76/Pala to Gird Rd., thence northerly on Gird Rd. to Knottwood Way, thence westerly on Knottwood Way to Flowerwood Ln.

Detour SB Flowerwood Ln.

Detour SB Flowerwood Ln. traffic via northerly on Flowerwood Ln. to Knottwood Way, thence easterly on Knottwood Way to Gird Rd., thence southerly on Gird Rd. to Rte. 76/Pala Rd.

When the Road is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76 warning the traffic of the closure ahead.

Chart no. H9
City Street Requirements and Hours of Work

County: SD	Route/Direction: NB-SB Flowerwood Ln.	PM:
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Closure limits: At Rte. 76

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
Mon-Thu	X	X	X	X	X																		X	X	X
Fri	X	X	X	X	X																				
Sat																									
Sun																							X	X	X

Legend:

Street may be closed

No lane closure allowed, shoulders may be closed

REMARKS:

No other closure that conflicts with or shares any elements of the following detour will be permitted.

Detour NB Flowerwood Ln.

Detour NB Flowerwood Ln. traffic via Rte. 76/Pala to Gird Rd., thence northerly on Gird Rd. to Knottwood Way, thence westerly on Knottwood Way to Flowerwood Ln.

Detour SB Flowerwood Ln.

Detour SB Flowerwood Ln. traffic via northerly on Flowerwood Ln. to Knottwood Way, thence easterly on Knottwood Way to Gird Rd., thence southerly on Gird Rd. to Rte. 76/Pala Rd.

When the Road is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76 warning the traffic of the closure ahead.

**Chart no. H10
City Street Requirements and Hours of Work**

County: SD	Route/Direction: NB-SB / Gird Rd.	PM:
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Closure limits: At Rte. 76

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
Mon-Thu	X	X	X	X	X																		X	X	X
Fri	X	X	X	X	X																				
Sat				X	X	X	X	X	X	X	X														
Sun				X	X	X	X	X	X	X	X												X	X	X

Legend:

- Street may be closed
- No lane closure allowed, shoulders may be closed

REMARKS:

No other closure that conflicts with or shares any elements of the following detour will be permitted.

Detour NB Gird Rd.

Detour NB Gird Rd. traffic via Rte. 76/Pala to Flowerwood Ln., thence northerly on Flowerwood Ln. to Knottwood Way, thence easterly on Knottwood Way to Gird Rd.

Detour SB Gird Rd.

Detour SB Gird Rd. traffic via southerly on Gird Rd. to Knottwood Way, thence westerly on Knottwood Way, to Flowerwood Ln., thence southerly on Flowerwood Ln. to Rte. 76/Pala Rd.

When the Road is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76 warning the traffic of the closure ahead.

**Chart no. H11
City Street Requirements and Hours of Work**

County: SD	Route/Direction: NB-SB / Oak Creek	PM:
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Closure limits: At Rte. 76

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
Mon-Thu	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fri																									
Sat																									
Sun																									

Legend:
 X Street may be closed
 No lane closure allowed, shoulders may be closed

REMARKS:

 Allow access for local traffic only.
 This chart to be used for a maximum of two (2) days only.

 When the Road is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76 warning the traffic of the closure ahead

**Chart no. H12
City Street Requirements and Hours of Work**

County: SD	Route/Direction: Calle de la Vuelta Monserate Hill Rd. Oak Creek	PM:
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Closure limits: At Rte. 76

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
Mon-Thu	X	X	X	X	X																	X	X	X	
Fri	X	X	X	X	X																				
Sat																									
Sun																						X	X	X	

Legend:

Street may be closed

No lane closure allowed, shoulders may be closed

REMARKS:

Allow access for local traffic only

When the Road is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76 warning the traffic of the closure ahead

**Chart no. H13
Complete City Street Closure Hours**

County: SD							Route/Direction: EB-WB / Via Altamira							PM:											
Closure limits: At Old Highway 395																									
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
Mon-Thu	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fri	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sat	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sun	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Legend:
 X Street may be closed

REMARKS:
 No other closure that conflicts with or shares any elements of the following detour will be permitted. This chart to be used for a maximum of two (2) continuous weeks only.

Detour EB Via Altamira
 Detour EB Via Altamira traffic via Altamira to Via De Todos Santos, thence northerly on Via De Todos Santos to Via Belmonte., thence easterly on Via Belmonte to Old Hwy 395.

Detour WB Via Altamira
 Detour WB Via Altamira traffic via Old Hwy 395 to Via Belmonte., thence westerly on Via Belmonte to Via Altamira.

When the Road is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76 warning the traffic of the closure ahead

**Chart no. H14
City Street Requirements and Hours of Work**

County: SD	Route/Direction: NB-SB Old Highway 395	PM:
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Closure limits: At Rte. 76

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
Mon-Thu								X	X	X	X	X	X	X	X	X	X	X	X						
Fri								X	X	X	X	X	X	X	X	X	X	X	X						
Sat																									
Sun																									

Legend:

- Street may be closed
- No lane closure allowed, shoulders may be closed

REMARKS:

- 7. This chart to be used for blasting, two (2) times per hour only.
- 8. Close traffic lanes and stop public traffic for periods not to exceed (5) five minutes per closure.
- 9. All Queued traffic must be cleared prior to stopping traffic again.
- 10. The Engineer will coordinate with the Contractor if the use of Cozeep during this operation is required.

When the Road is closed, place a PCMS (Portable Changeable Message Sign) on NB-SB 395 warning the traffic of the closure ahead.

When the Highway is closed, place a PCMS (Portable Changeable Message Sign) on EB-WB 76, warning the traffic of the closure ahead,

**Chart no. H15
City Street Requirements and Hours of Work**

County: SD	Route/Direction: NB-SB Old Hwy. 395	PM:
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Closure limits: At Rte. 76

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
Mon-Thu		R	R	R	R	R																	R	R	R
Fri		R	R	R	R	R																			
Sat																									
Sun																							R	R	R

Legend:

R Provide at least 1 through traffic lane, not less than 10 feet in width, for use by both directions of travel
(Reversing Control)

No lane closure allowed, shoulders may be closed

REMARKS:

NOTE: When Reverse Traffic Control is used:
3. Close one traffic lane and stop public traffic for periods not to exceed (10) ten minutes.
4. Maximum length of one-way control shall be 0.25 mi.

Chart no. H16 Complete City Street Closure Hours																									
County: SD						Route/Direction: NB-SB Old Highway 395						PM:													
Closure limits: At Rte. 76																									
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
Mon-Thu	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fri	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sat	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sun	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Legend: <input type="checkbox"/> X Street may be closed																									
REMARKS: 11. This chart to be used for Hauling Trucks across old Highway 395 Rd. 12. Allow haul trucks to pass. Stop public traffic for periods not to exceed (1) one minutes per closure at a maximum of (10) ten closures per hour. Queued traffic must be cleared prior to stopping traffic again. When the Road is closed, place a PCMS (Portable Changeable Message Sign) on NB-SB 395 warning the traffic of the closure ahead.																									

AA

13 WATER POLLUTION CONTROL

Add to section 13-3.01A:

The project is risk level 2.

Replace the 4th paragraph in section 13-3.01A with

Discharges of stormwater from the project must comply with the permit issued by the San Diego RWQCB for *National Pollutant Discharge Elimination System (NPDES) Permit Clean Water Act Section 401, Permit No. R9-2013-0035*. The San Diego RWQCB permit governs stormwater and nonstormwater discharges resulting from construction activities in the project area. The San Diego RWQCB permit is included in the *Information Handout*.

Add to section 13-10.03A:

You may place gravel-filled bags within a shoulder area without Type K temporary railing under any of the following conditions:

1. The section of roadway with the shoulder is not open to public traffic.
2. The gravel-filled bags are;
 - 2.1. Beyond 30 feet from the edge of traveled way for freeways and expressways, or
 - 2.2. Beyond 20 feet from the edge of traveled way for conventional highways.

- The gravel-filled bags on the shoulder are within a temporary lane closure and the bags are removed prior to the lane closure being removed.

AA

14 ENVIRONMENTAL STEWARDSHIP

Add to section 14-1.02A:

An ESA exists on this project.

Before start of work, protect the ESA by installing Type ESA (temporary fence) or temporary arroyo toad fence as shown.

Limited access to the ESA is allowed for biological monitoring, water quality testing, temporary arroyo toad fence maintenance and removal of Erconet netting system. Notify the Engineer 2 business days before the planned entry date. Any other access to an ESA is prohibited.

Take the management measures shown in the following table for the corresponding ESA shown. Any access to an ESA other than that shown is prohibited.

ESA Management		
Identification	Location	Limited access allowed for: Management measures
ESA	G-29 and L-29	During highway construction: 1.) Biological monitoring 2.) Invasive species removal During Planting: 3.) Remove (Type ESA) temporary fence 4.) install irrigation 5.) planting 6.) grade access road 7.) Plant establishment.
ESA	G-30 and L-30	During highway construction: 1.) Biological monitoring 2.) Invasive species removal During Planting: 3.) Remove (Type ESA) temporary fence 4.) install irrigation 5.) planting 6.) grade access road 7.) Plant establishment.

Construction night lighting must be shielded or directed away from adjacent ESA.

Replace the 3rd paragraph in section 14-1.03A(1) with:

Signs for temporary fence (Type ESA) will not be required.

Add to section 14-2.03A:

AMAs within, near, or straddling the project limits are shown on the plans.

Replace the 2nd and 3rd paragraphs in section 14-2.03A with:

The Department assigns a archaeological and a Native American monitor to monitor job site activities within the AMA. Do not work within the AMA unless the archeological and Native American monitors are present.

The Engineer and the Department's archaeological and Native American monitors 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.

Replace section 14-6.02 with:

14-6.02 SPECIES PROTECTION

14-6.02A General

Section 14-6.02 includes specifications for protecting regulated species or their habitat.

This project is within or near habitat for regulated species shown in the following table:

Species Name
Migratory birds
Arroyo toad
plant San Diego ambrosia

14-6.02B Material

Not Used

14-6.02C Construction

14-6.02C(1) General

Not Used

14-6.02C(2) Protective Radius

Upon discovery of the regulated species arroyo toad or plant San Diego ambrosia, stop construction activities within a 50 foot radius of the discovery. Immediately notify the Engineer. Do not resume activities until receiving notification from the Engineer.

14-6.02C(3) Protocols

Not used.

14-6.02C(4) Biological Resource Information

Not used.

14-6.02C(5) Protection Measures

Within project limits, implement the following protection measures:

BIRD PROTECTION:

1. Chain and mow prior to nesting or attempted nesting by migratory and nongame birds.
2. If additional clearing of vegetation is required during the bird nesting season a pre-construction survey will be conducted by a qualified Biologist provided by the Department. During the bird nesting season you must notify the Engineer 15 working days before starting work that disturbs the vegetation. Notification must include the timing and sequence of work to be performed. The Engineer with authorize the start of work.
3. If evidence of bird nesting is discovered during the nesting season you must immediately:
 - A. Stop all work within the protective radius
 - B. Notify the Engineer
4. The active bird nesting area will be designated as an ESA within the protective radius. The boundary of the active nesting area must be delineated with Type ESA temporary fence.

5. When active nesting is over remove Type ESA temporary fence, the area will no longer be considered an ESA.

ARROYO TOAD PROTECTION:

1. Maintain existing arroyo toad fence during the arroyo toad active season.
2. During the arroyo toad active season a qualified biologist will be provided by the Department to monitor the existing arroyo toad fence.
3. If there is a breach in the existing arroyo toad fence, the Biologist will perform a minimum of 6 consecutive night surveys for arroyo toads to verify the presence or absence of arroyo toads. No work shall be performed within the protective radius. If any arroyo toads are found during the surveys, then the surveys will continue until there have been 2 consecutive nights without arroyo toads within the work area. The Engineer will authorize the start of work.
4. If arroyo toads are discovered within at the job site, do not disturb the arroyo toads and immediately:
 - A. Stop work within the protective radius.
 - B. Notify the Engineer.
 - C. The Biologist will perform a minimum of 6 consecutive night surveys for arroyo toads to verify the presence or absence of arroyo toads. No work shall be performed within the protective radius. If any arroyo toads are found during the surveys, then the surveys will continue until there have been 2 consecutive nights without arroyo toads within the work area. The Engineer will authorize the start of work.

PLANT SAN DIEGO AMBROSIA:

1. A qualified biologist will be provided by the Department to monitor for plant species San Diego ambrosia.
2. If plant species San Diego ambrosia is discovered within at the job site, do not disturb the area and immediately:
 - D. Stop work within the protective radius.
 - E. Notify the Engineer.
3. The plant species San Diego ambrosia will be removed by the Biologist and the area will no longer be an ESA.

14-6.02C(6) Monitoring Schedule

Monitoring type	Schedule for nesting and active season
Migratory birds	February 15 to September 15
Arroyo toad	March 15 to July 31
plant San Diego ambrosia	All year

14-6.02D Payment

Not Used

Replace the 3rd paragraph of section 14-6.03A with:

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

Replace item 1 in the list in the 7th paragraph of section 14-6.03A with:

1. Stop all work within radius of the discovery as shown in the following table:

Radius	
Species	Work stoppage radius (feet)
General migratory birds, Coastal California gnatcatcher, Least Bell's vireo, Southwestern willow flycatcher.	300
Raptors	500

Replace section 14-6.09 with:

14-6.09 TEMPORARY WETLAND PROTECTION MAT

14-6.09A General

14-6.09A(1) Summary

Section 14-6.09 includes specifications for installation and removal of temporary wetland protection mats to minimize damage to wetlands.

You may use mats to cross wetlands if specifically permitted by regulatory agencies. Furnish, install, maintain, and remove the wetland protection mats in a manner consistent with laws, regulations, and PLACs.

14-6.09A(2) Definitions

temporary wetland protection mat: Device placed temporarily on a wetland to minimize damage to the wetland soils and habitat.

14-6.09A(3) Submittals

Submit for acceptance a schedule for the placement and removal of wetland protection mats. Include location, mat type, and placement and removal dates for each location. Describe the method of installing and removing wetland protection mats.

Submit a certificate of compliance for temporary wetland protection mat.

14-6.09A(4) Quality Control and Assurance

Prevent permanent damage and minimize temporary damage to wetlands according to permit requirements.

14-6.09B Materials

Mats must be designed for use as temporary roadways and to protect the ground without ground preparation. Mats must be made of HDPE and be a minimum of 4 feet wide, 8 feet long, and 1/2 inch thick. Mats must have a load-bearing capacity of 60 tons or greater.

14-6.09C Construction

14-6.09C(1) General

Not Used

14-6.09C(2) Installation

Mats must be free of all soil, seeds, or other organic or hazardous material before entering the work area.

Do not install mats in a wetland or cross the wetland until receiving written acceptance from the Engineer for the temporary wetland crossing.

Conduct all temporary installation activities from areas outside of wetlands or on mats.

14-6.09C(3) Inspection

Inspect, clean, and maintain mats. Immediately replace or repair damaged or broken mats.

14-6.09C(4) Removal

Remove mats when wetland crossing is no longer needed. Remove mats to an appropriate washout location and clean before transporting offsite. The washout location must be outside of wetlands and ESAs and inside the cleared work area where wash-water and other material will not transport into any wetlands, streams, or ESAs.

14-6.09D Payment

Not Used

Replace section 14-6.12 with:

14-6.12 BAT HOUSE

14-6.12A General

14-6.12A(1) Summary

Section 14-6.12 includes specifications for furnishing and installing pre-manufactured bat houses as shown.

14-6.12B Materials

Each bat house must be designed to house up to 150 bats and must not be fabricated with wood products.

Bat houses must be from one of the following manufacturers or equivalent;

1. Bat Conservation International - Plastic Insulated Bat House with Stucco Finish (BH-7);
2. Maberry Centre Bat Homes - PI Multi-Chamber Bat House;
3. Rubicon – Four Chambered Bat House (RUB-BTH100G).

14-6.12C Construction

14-6.12C(1) General

Not Used

14-6.12D Payment

Bat houses will be measured by the unit in place.

Replace "Reserved" in section 14-6.13 with:

14-6.13 TEMPORARY ARROYO TOAD FENCE

14-6.13A General

14-6.13A(1) Summary

Section 14-6.13 includes specifications for installing and maintaining and removing temporary arroyo toad fence.

Install temporary arroyo toad fence as shown.

Comply with section 5-1.36.

14-6.13A(2) Definitions

Not Used

14-6.13A(3) Submittals

Not Used

14-6.13B MATERIALS

Temporary arroyo toad fence must be constructed with orange silt fence fabric, wood posts, and fasteners and decomposed granite filled bags.

Fence fabric must comply with section 88-1.02E.

Decomposed granite-filled bags must comply with section 88-1.02F.

Bags must have a length between 2' to 2'-8" and a width of 1'-4" to 1'-8"

Decomposed granite must be igneous rock obtained from within the project limits. Decomposed must be clean and free from organic matter, and other deleterious materials.

Decomposed granite must comply with the grading for the sieve sizes and quality requirements shown in the following tables:

Sieve Size	Percent Passing
2"	100
1"	90-100
No. 4	50-100
No. 30	25-55
No. 200	5-18

Test	Operating Range	Contract Compliance
Sand Equivalent	-----	20
Resistance (R-value)	-----	60

Post must be wood complying with section 13-10.02C.

The orange silt fence fabric must be attached to wooden posts with staples as shown.

Secure the opening of decomposed granite filled bags to prevent decomposed granite from escaping.

Fill the decomposed granite filled bags between 30 to 48 pounds of material.

Yarn used for binding gravel bags must be as recommended by the manufacturer or bag supplier.

Decomposed granite must be igneous rock obtained from within the project limits. Decomposed shall be clean and free from organic matter, and other deleterious materials.

14-6.13C Construction

For the installation and maintenance of temporary arroyo toad fence comply with section 13-10.03.

The orange silt fence fabric must be installed on the side of the posts facing the work area.

The maximum post spacing may be increased to 10 feet if the fence is reinforced by a wire or plastic material by prefabrication or by field installation.

Temporary arroyo toad fence must be joined as shown.

The tops of the posts must be tied together by minimum of 2 wraps of tie wire of a minimum 1/16-inch diameter.

The silt fence fabric must be attached to the posts at the joint as specified in these special provisions.

Place a single layer of decomposed granite filled bags with ends abutted tightly and not overlapped.

14-6.13D Payment

Not Used

**Replace "Reserved" section 14-6.14 with:
14-6.14 REALIGNMENT OF SUBORDINATE CHANNELS**

14-6.14 GENERAL

14-6.14A Summary

Section 14-6.14 includes specifications for the temporary realignment of subordinate channels and for incursions in to the San Luis Rey River and Live Oak Creek.

The Department will provide a Biologist to monitor temporary realignment activities.

In addition to Section 5-1.36 you are liable for damages from upstream or downstream flooding or high flow velocities caused by construction activities and you are liable for damages resulting from erosion downstream or upstream of the project caused by construction activities.

14-6.14B Definitions

Alluvium: Clay, silt, sand, gravel, or similar detrital material deposited by running water.

Alluvial Channel: Channel formed wholly in alluvium with no bedrock exposed in the channel at low flow or likely to be exposed by erosion. A channel whose processes are controlled by the flow and boundary interactions.

Subordinate channel: A small alluvial channel contained within the main river channel. There can be multiple subordinate channels within the main river channel. These channels are separated from one another by sand bars or islands. The channels and sand bars or islands are usually highly mobile, with the river layout often changing significantly during flood events. Includes thalweg.

Thalweg: The line or path (such as a rill) connecting the lowest flow points along the bed of a channel. The line does not include local depressions. The path that very low flows would follow while proceeding down a stream, river, swale or channel. The line extending along a channel profile that follows the lowest elevation of the bed.

HEC-RAS: A computer program developed by Hydrologic Engineering Center (HEC) for the United States Army Corps of Engineers. HEC-RAS is designed to perform one-dimensional hydraulic calculations for a full network of natural and constructed channels. The HEC-RAS program can be obtained for free at the United States Army Corp of Engineer website:
www.hec.usace.army.mil/software/hecras/

14-6.14C Submittals

14-6.14C(1) General

When requested, submit 3 copies of the hydraulic analysis before starting work impacting the San Luis Rey River floodplain or Live Oak Creek floodplain for review.

The hydraulic analysis must consider the following work:

1. Storage areas
2. Falsework
3. Stockpiling of material within the floodplain limits

The hydraulics analysis must be performed using the HEC-RAS software. The hydraulic analysis must be signed by an engineer who is registered as a civil engineer in the State.

Review time for any submittal of hydraulic analysis is 60 working days.

Submit 3 copies of the temporary realignment plan before starting work impacting the San Luis Rey River or Live Oak Creek for review. Temporary realignment plan must include:

1. Plan, profile and cross sections (every 25 feet, minimum) along the length of proposed realignment showing existing ground and proposed ground.
2. Timeline of proposed realignment.

After each plan is authorized, submit 3 additional copies of each authorized plan.

Review time for temporary realignment plan is 30 days, once authorized you may implement the temporary realignment plan.

Resubmittal of the temporary realignment plan for each incursion into the river, if required, must be submitted no less than 30 working days before starting work that impacts the San Luis Rey River or Live Oak Creek.

Changes to the temporary realignment plan made to adjust for site conditions must be submitted 30 days for review and must be authorized before implementing.

If the temporary realignment plan requires a change to a PLAC comply with section 5-1.20B(2) prior to submitting the temporary realignment plan.

14-6.14D MATERIALS

Not Used

14-6.14E CONSTRUCTION

1. Temporary piles and cofferdams must be removed 10 feet below the original ground.
2. Features modified by temporary construction within San Luis Rey River and Live Oak Creek must be returned to their original conditions.

14-6.14F PAYMENT

Not Used

Replace section 14-7.03 with:

14-7.03 PALEONTOLOGICAL RESOURCES MITIGATION

14-7.03A General

14-7.03A(1) Summary

Section 14-7.03 includes specifications for coordinating and working with a paleontological resources mitigation team provided by the Department.

The Department performs paleontological resources mitigation during construction activities involving subsurface disturbance under Pub Res Code § 5097.5 and the California Environmental Quality Act (CEQA). Do not start subsurface-disturbing activities until the paleontological mitigation team, consisting of a principal paleontologist and paleontological monitors, is present at the job site.

Fossils within or excavated from the highway remain the property of the Department.

14-7.03A(2) Definitions

paleontological resources mitigation: Monitoring for fossils and salvage or in-place stabilization if fossils are found.

14-7.03A(3) Submittals

Submit a schedule of subsurface-disturbing activities at least 15 days before starting work. Submit an updated schedule at least 3 business days before implementing any changes.

14-7.03A(4) Quality Control and Assurance

Attend a preconstruction meeting with the paleontological resources mitigation team and the Engineer to establish procedures for coordination, cooperation, and worker safety during mitigation activities.

Request paleontological-resource-awareness training 10 days before the start of work. All of your personnel and subcontractors involved in subsurface-disturbing activities must complete 1 hour of training provided by the mitigation team before working at the job site.

14-7.03B Materials

Not Used

14-7.03C Construction

Within the project limits, do not perform subsurface-disturbing activities unless authorized. Notify the Engineer 15 days before starting subsurface-disturbing activities.

The paleontological mitigation team monitors and salvages fossils discovered during excavation.

The Engineer may order you to:

1. Divert or stop construction activities in the vicinity of fossils
2. Avoid disturbing an area pending the removal of fossils
3. Perform additional excavation
4. Modify an excavation to facilitate in-place stabilization of fossils by the mitigation team

14-7.03D Payment

Additional excavation and modification of an excavation to facilitate in-place stabilization of fossils if ordered are change order work.

Replace "Reserved" in section 14-7.04 with:

14-7.04 CONTRACTOR ENVIRONMENTAL EDUCATION PROGRAM

14-7.04A General

14-7.04A(1) Summary

Section 14-7.04 includes specifications for environmental education program.

A Contractor Environmental Education Program will be provided to ensure that all the Contractor's personnel are provided training in the requirements of the United States Fish and Wildlife Service Biological Opinion, California Fish and Wildlife Streambed Alteration Agreement and monitoring requirements of the potentially sensitive cultural resource areas within the project limits.

14-7.04B Materials

Not Used

14-7.04C Construction

14-7.04C(1) General

The Department will present a 2-hour Environmental Educational Program to all the Contractor's personnel at the first scheduled safety meeting held by the Contractor's Project Manager, or as agreed upon by the Engineer and the Contractor.

14-7.04C(2) Training

The content of the educational program will focus on:

- 1) The purpose for resource protection;
- 2) The description of sensitive species and their habitats;
- 3) Conservation measures that should be implemented during construction, including strictly limiting activities, vehicles, equipment, and construction areas fenced to avoid impacts to sensitive resource areas;
- 4) Environmentally responsible construction practices;
- 5) Protocol to resolve conflicts that may arise during the construction process;
- 6) General provisions of the Endangered Species Act, the need to adhere to the provisions, and the penalties associated with violating the Endangered Species Act;
- 7) Working within sensitive cultural resource areas and monitoring requirement protocol.

14-7.04C(3) New Personnel

For new contractor personnel a refresher Environmental Educational Program will be presented at a regularly scheduled safety meeting held by the Contractor's Project Manager or as agreed upon by the Engineer and the Contractor.

14-7.04D Payment

Not Used

Replace the 2nd paragraph of section 14-8.02A with:

Do not exceed 86 dBA LMax at 50 feet from the job site activities from 9 p.m. to 6 a.m. in addition you may not perform the following activities during the hours and for the days shown in the following table:

Noise Restriction

Activity	Hours		Days	
	From	To	From	Through
Pile Driving	7:00 p.m.	7:00 a.m.	Monday	Friday
Blasting	7:00 p.m.	7:00 a.m.	Monday	Friday
Pile Driving	7:00 p.m.	Midnight	Friday	Friday
Blasting	7:00 p.m.	Midnight	Friday	Friday

No pile driving or blasting on Saturdays or Holidays.

Replace section 14-11.09 with:

14-11.09 TREATED WOOD WASTE

14-11.09A General

14-11.09A(1) Summary

Section 14-11.09 includes specifications for handling, storing, transporting, and disposing of treated wood waste (TWW).

Wood removed from fence, gates, metal beam guard railing, log barrier and roadside signs is TWW. Manage TWW under 22 CA Code of Regs, Div. 4.5, Chp. 34.

14-11.09A(2) Submittals

For disposal of TWW, submit as an informational submittal a copy of each completed shipping record and weight receipt within 5 business days.

14-11.09B Materials

Not Used

14-11.09C Construction

14-11.09C(1) General

Not Used

14-11.09C(2) Training

Provide training to personnel who handle TWW or may come in contact with TWW. Training must include:

1. Applicable requirements of 8 CA Code of Regs
2. Procedures for identifying and segregating TWW
3. Safe handling practices
4. Requirements of 22 CA Code of Regs, Div. 4.5, Chp. 34
5. Proper disposal methods

Maintain records of personnel training for 3 years.

14-11.09C(3) Storage

Store TWW before disposal using the following methods:

1. Elevate on blocks above a foreseeable run-on elevation and protect from precipitation for no more than 90 days.
2. Place on a containment surface or pad protected from run-on and precipitation for no more than 180 days.
3. Place in water-resistant containers designed for shipping or solid waste collection for no more than 1 year.

4. Place in a storage building as defined in 22 CA Code of Regs, Div. 4.5, Chp. 34, § 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 job site.

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 22 CA Code of Regs, Div. 4.5, Chp. 34, §67386.5, to clearly mark and identify TWW and accumulation areas. Labels must include:

1. Caltrans, District number, Construction, Construction Contract number
2. District office address
3. Engineer's name, address, and telephone number
4. Contractor's contact name, address and telephone number
5. Date placed in storage

14-11.09C(4) Transporting and Disposal

Before transporting TWW, obtain an agreement from the receiving facility that the TWW will be accepted. Protect shipments of TWW from loss and exposure to precipitation. For projects with 10,000 lb or more of TWW, request a generator's EPA Identification Number at least 5 business days before the 1st 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 with 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. Generator's EPA Identification Number for projects with 10,000 lb or more of TWW

The shipping record must be at least a 4-part carbon or carbonless 8-1/2-by-11-inch 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 is available at:

<http://www.dtsc.ca.gov/HazardousWaste/upload/lanfillapr11pdated1.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. 1 year of generation if stored in a water-resistant container or within 90 days after the container is full, whichever is shorter
4. 1 year of generation if storing in a storage building as defined in 22 CA Code of Regs, Div. 4.5, Chp. 34, § 67386.6(a)(2)(C)

14-11.09D Payment

Not Used

AA

15 EXISTING FACILITIES

Replace section 15-1.03E with:

15-1.03E ARROYO TOAD FENCE

Maintain the existing arroyo toad fence until the start of Plant Establishment or the completion of the wildlife fence whichever comes later.

Maintain existing arroyo toad fence by:

1. Cutting and removing fallen trees
2. Cutting vegetation back 5 feet from fence
3. Adjusting and keeping posts in a vertical position
4. Reattaching fabric to posts
5. Replacing damaged sections of fabric
6. Remove fence when no longer needed

Replace section 15-2.02C(2) with:

15-2.02C(2) Remove Traffic Stripes and Pavement Markings Containing Lead

Residue from removing traffic stripes and pavement markings contains lead from the paint or thermoplastic. The average lead concentrations are less than 1,000 mg/kg total lead and 5 mg/L soluble lead. This residue:

1. Is a nonhazardous waste
2. Does not contain heavy metals in concentrations that exceed thresholds established by the Health and Safety Code and 22 CA Code of Regs
3. Is not regulated under the Federal Resource Conservation and Recovery Act (RCRA), 42 USC § 6901 et seq.

Submit a lead compliance plan under section 7-1.02K(6)(j)(ii).

Payment for a lead compliance plan is not included in the payment for existing facilities work.

Payment for handling, removal, and disposal of pavement residue that is a nonhazardous waste is included in the payment for the type of removal work involved.

Replace section 15-2.02F with:

15-2.02F Remove Asphalt Concrete Dikes

You may dispose of the dike by burial in an embankment in the same manner as specified for burying concrete in an embankment in section 15-3.01.

Replace section 15-2.02N with:

15-2.02N Remove Mud ,Sand and Debris

15-2.02N(1) General

15-2.02N(1)(a) Summary

Section 15-2.02N includes specifications for removing mud, sand and debris from inside and outside of culverts as shown.

15-2.02N(1)(b) Submittals

Submit a plan to show how the mud, sand and debris is to be removed. Plan is to include the methods used to prevent the material from entering the waterway and damaging the facilities.

15-2.02N(2) Materials

Not Used

15-2.02N(3) Construction

Not Used

15-2.02N (4) Payment

Remove mud, sand, and debris is measured along the flowline inside and outside the culvert.

Replace section 15-2.02P with:

15-2.02P Remove Barrier

Where removing log barrier, remove any posts, mounts, and hardware.

Add the following to section 15-2.03A(1):

Salvage the following:

1. remote control valves
2. gate valves
3. sprinklers

Replace section 15-2.03A(2)(b) with:

15-2.03A(2)(b) Department Salvage Location

A minimum of 2 business days before hauling salvaged material to the Department salvage storage location, notify:

1. Engineer

For irrigation facilities, the Department salvage storage location is:

Kearny Mesa Construction Field Office
7177 Opportunity Rd, San Diego, CA, 92111

Replace section 15-2.03A(4) with:

15-2.03A(4) Payment

Payment for salvaging irrigation facilities is included in the payment for remove irrigation facility.

Replace section 15-2.05C with:

15-2.05C Abandon Culverts and Pipelines

15-2.05C(1) General

Abandon culverts or pipelines by removing portions of the culverts or pipelines, filling the inside, and backfilling the depressions and trenches to grade. As an alternative to abandoning a culvert or pipeline, you may remove the culvert or pipeline, dispose of it, and backfill.

Notify the Engineer before abandoning a culvert or pipeline.

15-2.05C(2) Materials

Openings into existing structures that are to remain in place must be plugged with minor concrete under section 90.

15-2.05C(3) Construction

Wherever culverts or pipelines intersect side slopes, remove them to a depth of at least 3 feet. Measure the depth normal to the plane of the finished side slope. Abandon the remaining portion of the culvert or pipeline.

Culverts or pipelines that are 12 inches or more in diameter must be completely filled by authorized methods. Backfill with sand that is clean, free draining, and free from roots and other deleterious substances. As an alternative to sand, you may backfill with one of the following:

1. Controlled low-strength material under section 19-3.02F
2. Slurry cement backfill under section 19-3.02D

Ends of culverts and pipelines must be securely closed by a 6-inch-thick, tight-fitting plug or wall of commercial-quality concrete.

15-2.05C(4) Payment

If backfilling inside the culvert or pipeline is required, payment for backfilling inside the culvert or pipeline is paid for as sand backfill. Payment for backfilling outside the culvert or pipeline is included in the payment for abandon culvert or abandon pipeline.

Replace section 15-2.02M with:

15-2.02M REMOVE STEEL CASING

15-2.02(1) General

Section 15-2.02M includes specifications for removing steel casing.

15-2.02M(2) Materials

Slurry cement backfill must comply with section 19-3.02D.

Sand must conform to that for sand beddings in section 19-3.02E(2).

15-2.02M(3) Construction

Remove all erconet webbing and appurtenances.

Remove portions of steel casings as shown.

Abandon in place remaining portions of steel casings byfilling inside with sand and capping inside the tops with at least 2 feet of slurry cement backfill. If inside portion of a casing to be abandoned is filled with existing material to within 2 feet of its top, excavate it to at least 2 feet below the top before capping.

15-2.02M(4) Payment

Not Used

Replace section 15-2.06B with:

15-2.06B Destroy Wells

15-2.06B(1) General

15-2.06B(1)(a) Summary

Destroying wells must comply with:

1. Regulations of San Diego County
2. *Water Well Standards, Bulletin 74-81*
3. *Water Well Standards, Bulletin 74-90*
4. Water Code, §§ 13750.5–13753

Destroy wells after clearing and grubbing and before starting earthwork.

Where pumping equipment is present, remove the pump, motor, discharge piping, well cap, and appurtenances. Remove concrete at the wellhead.

DIVISION III GRADING

16 CLEARING AND GRUBBING

Replace section 16-1.02 with:

16-1.02 CHAIN AND MOW

16-1.02A General

Chain and mow prior to the start of migratory and nongame bird nesting season February 15 through September 15 to allow clear and grub anytime during the year.

16-1.02B Construction

Chain and mow vegetation and trees.

Mow or cut vegetation to a minimum of 4 inches or maximum of 8 inches above the existing ground.

Cut trees to a minimum of 2 feet or maximum of 4 feet above the existing ground.

Replace the 4th paragraph in section 16-1.03A with:

Clear and grub vegetation only within the excavation and embankment slope lines, and as shown.

Add to section 16-1.03A:

Clear arundo and tamarisk by removing all seed stalks and flower heads, and immediately bagging them for disposal.

Within clearing and grubbing areas remove plant stumps, roots and rhizomes by mechanical means as follows:

1. Remove the entire root crown or mass and rhizomes.
2. Do not leave plant or root pieces in or on the soil after removal.
3. Dispose of all removed material.

Clear dirt paths down to original ground within the Vessels Mitigation job site as shown.

Replace the 1st paragraph in section 16-1.03B with:

Clear the area of all objectionable material including trees, vines, logs, upturned stumps, downed trees, plants, brush, grass, weeds, trash, concrete, and masonry.

Replace section 16-1.03C with:

Grub the areas of all objectionable material including trees, logs, buried stumps, downed trees, trash, concrete, and masonry.

Remove trees, stumps, rhizomes and roots completely where work includes:

1. Roadway excavation
2. Earthwork slope construction
3. Structure construction
4. Pile construction
5. Trench, ditch, or channel excavation
6. Removal of unsuitable material

19 EARTHWORK

Add to section 19-1.01A:

If paleontological resources mitigation is specified under section 14-7.03, excavation work includes:

1. Paleontological resources training of your staff and subcontractors
2. Submittals of your schedule of subsurface-disturbing activities and updated schedules
3. Coordination and working with the mitigation team provided by the Department

Add to section 19-2.03A:

Submit a work plan for excavation before starting earthwork activities.

The work plan must include the following:

1. Methods to control loose rock or in-tact soil clods from leaving the excavation zone
2. Methods to prevent loose rock from rolling, bouncing or falling off the project slopes
3. Methods to protect employees and the public from damage due to rolling, bouncing or falling rock

Demonstrate that the control methods you propose will prevent the rolling, bouncing or falling rock from leaving the work zone.

At the end of each work day review the slopes for possible rolling, bouncing or falling rock and oversee the placement of control method(s) as required.

Add to section 19-2.03A:

Process material from roadway excavation (Type C) by dewatering, scarifying, aerating, spreading, blending, or any other means if necessary to dry it before excavating or placing and compacting the material.

Add to section 19-2.04:

Payment for roadway excavation (Type C) includes moving the material multiple times if necessary for processing before placing it.

Replace "Reserved" in section 19-3.03A with:

Where shown, remove material below the bottom of retaining wall and wing wall footings. Replace with Class 2 aggregate base and place and compact as specified for structure backfill in section 19-3.03E. Relative compaction must be at least 95 percent.

Pervious backfill material placed within the limits of payment for box culvert wing walls is included in the payment for structural concrete, box culvert.

Replace section 19-4 with:

19-4 ROCK EXCAVATION (CONTROLLED BLASTING)

19-4.01 GENERAL

19-4.01A Summary

Section 19-4 includes specifications for performing rock excavation with controlled blasting.

You may use hydraulic splitters, pneumatic hammers, controlled blasting, or other roadway excavation techniques authorized to fracture rock and construct stable final rock cut faces.

Comply with section 12.

Comply with federal, state, and local blasting regulations. Regulations containing specific Cal-OSHA requirements for blasting activities include 8 CA Code of Regs, Ch 4, Subchapter 7, Group 18, "Explosive Materials." Regulations for explosives containing percholate materials include 22 CA Code of Regs, Division 4.5, Ch 33, "Best Management Practices for Percholate Materials."

You are liable for damages resulting from blasting activities.

19-4.01B Definitions

controlled blasting: Use of explosives and blasting accessories in predetermined spaced and aligned drill holes to limit blast vibrations, noise from airblast overpressure, and flyrock.

flyrock: Rock that becomes airborne due to blasting.

near field blasting: Blasting within 30 feet of a critical structure.

19-4.01C Submittals

19-4.01C(1) General

Submit 3 copies of the blasting safety plan and each controlled blasting plan. After each plan is authorized, submit 3 additional copies of each authorized plan.

19-4.01C(2) Blasting Safety Plan

Submit a blasting safety plan. The plan must include:

1. References to applicable federal, state, and local codes and regulations
2. Copies of permits required for blasting activities
3. Business name, contractor license number, address, and telephone number of the blasting subcontractor
4. Proof of current liability insurance and bonding
5. Name, address, telephone number, copies of applicable licenses, and resume of:
 - 5.1. Blaster-in-charge
 - 5.2. Personnel responsible for controlled blast design, loading, and conducting the blasting operation
 - 5.3. Safety officer for blasting subcontractor
 - 5.4. Blast monitoring consultant
 - 5.5. Blasting consultant
6. Name, address, and telephone number of the local fire station and law enforcement agencies
7. Detailed description of:
 - 7.1. Location where explosives will be stored
 - 7.2. Security measures to protect and limit access to the explosives
 - 7.3. Transportation means for explosives
 - 7.4. List of personnel permitted to handle the explosives
8. Exclusion zone and limited-entry zone for nonblast related operations and personnel surrounding loading and blasting operations
9. Details of warning signals used to alert employees on the job site of an impending blast and to indicate the blast is completed and the area is safe to enter
10. How blasting operations will be conducted
11. Measures to protect blasting operations and personnel from lightning
12. Emergency evacuation procedures for areas where explosives may be present
13. How misfires will be recognized, handled, and resolved including:
 - 13.1. Who will be notified
 - 13.2. How blast zone will be secured until misfire is resolved
 - 13.3. Identification of equipment that may be needed to resolve misfires
14. Details of signs to be used around blasting zones including:
 - 14.1. Timing of when signs will be posted relative to a specific blast
 - 14.2. Name and telephone number of person responsible for placing signs
 - 14.3. Roadway signs for compliance with Chapter 6, Typical Application 2, of the California MUTCD.
15. Traffic control details for:
 - 15.1. Loading and blasting operations
 - 15.2. Misfire event or other blast related phenomenon that causes a transportation corridor to remain closed to the public

16. Description of possible noxious gas generation and details of safeguards to be used to protect employees, work zones adjacent to the shot, private property, and the public
17. Procedure to report and resolve complaints for blast related accidents
18. Copies of each MSDS and manufacturer data sheets of explosives, caps, primers, initiators, and other compounds

19-4.01C(3) Controlled Blasting Plan

Three days prior to loading any shot, submit a controlled blasting plan for each blast. The plan must include details on how each blast will be controlled and the following:

1. Blast identification by numerical and chronological sequence
2. Location, referenced to stationing, offset distance, date, and time of blast
3. Drawings showing drill hole pattern, spacing, burden, and initiation sequence
4. Typical cross-sections through zone to be blasted
5. Groundwater level, if present, within the prism to be blasted
6. Initiation-sequence diagram showing the actual firing time of each delay
7. Type of material to be blasted
8. Number of drill holes
9. Diameter, depth, and spacing of holes
10. Height or length of stemming
11. Types and characteristics of explosives used, including explosive's density, relative strength, and date of manufacture
12. Type of caps and delay periods used and their date of manufacture
13. Total amount of explosives used
14. Total amount of explosives detonating within any 8 millisecond period
15. Powder factor (pounds of explosive per cubic yard of material blasted)
16. Method of firing
17. Direction and distance to nearest building or structure
18. Type and method of instrumentation
19. Location and placement of instruments
20. Measures to limit air noise and flyrock
21. Measures to limit overbreak
22. Name of blasting subcontractor
23. Name and signature of blaster-in-charge
24. Drawings showing spacing and proximity of shot guards to blast location

Changes to the controlled blasting plan made to adjust for site conditions must be submitted for review before implementing.

19-4.01D Quality Control and Assurance

19-4.01D(1) General

Not Used

19-4.01D(2) Blaster-In-Charge

Assign a blaster-in-charge responsible for supervising all blasting activities. The blaster-in-charge must have 10 years of experience in performing or supervising similar blasting activities and must be a licensed blaster.

19-4.01D(3) Blast Monitoring Consultant

Assign a blast monitoring consultant to monitor blasting generated vibrations and noise near buildings and structures that may be subject to damage. The monitoring consultant must be responsible for collecting and interpreting vibration and noise data. The blast monitoring consultant must:

1. Not be employed by the blasting contractor or other subcontractor on the project
2. Have a minimum of a 2-year Associate's Degree in science or engineering
3. Have at least 5 years of documented experience in collecting and interpreting ground vibrations and noise data

19-4.01D(4) Blasting Consultant

Assign a blasting consultant to oversee near field blasting activities. The blasting consultant must:

1. Be an engineer or geologist who is licensed in the State
2. Have 10 years of experience providing specialized blasting services in near field blasting
3. Not be employed by the blasting contractor, explosive manufacturer, or explosive distributor
4. Submit a resume of credentials and a list of projects worked on

19-4.01D(5) Preblast Surveys

At least 15 days before starting blasting activities, prepare a preblast survey of all buildings and structures within 330 feet of blasting activities and submit it with the controlled blasting plan. The preblast survey must include a written report, sketches, and photos or a videotape with date and time displayed on the image. The preblast survey must include:

1. Name of the person making the inspection
2. Name of property owner and occupants
3. Property address
4. Date and time of the inspection
5. Description of the structure or other improvement including culverts and bridges
6. Detailed description of existing condition of walls, ceiling, and floor of each interior room including attic and basement
7. Detailed description of existing condition of foundations, exterior walls, roofs, doors, windows, and porches
8. Detailed description of existing condition of garages, outbuildings, sidewalks, driveways, and swimming pools
9. Detailed listing of highway sign posts, light fixtures, and overhead power lines
10. Survey of wells or other private water supplies including total depth and existing water surface levels
11. Identification of sites conducting procedures, processes, or operations that may be sensitive to blasting activities
12. Scaled map or aerial photo showing the location of structures and properties surveyed and location of all proposed blasting sites

If blasting activities are suspended for a period of 45 days or more, perform another preblast survey and submit it at least 15 days before resuming blasting activities.

After blasting activities are completed, prepare and submit a postblast survey of the same buildings and structures as in the preblast survey. The postblast survey must include all items included in the preblast survey.

19-4.01D(6) Vibration and Noise Monitoring

Vibration levels must be kept below peak particle velocity of 2 inches per second at the nearest building or structure.

Noise from airblast overpressure levels must be kept below 128 dB (C-network or Linear network) at the nearest building

Ground vibrations and noise created from blasting must be controlled by using properly designed delay sequencing and charge weights for shots.

Provide 3 seismographs to be available for deployment that are appropriate for controlled blasting activities and capable of:

1. Recording particle velocities for 3 mutually perpendicular components of vibration and instantaneous resultant peak vector sum in the range generally found with controlled blasting.
2. Continuously measuring, recording, and reporting vibrations along 3 primary axes.
3. Measuring and recording vibration frequencies ranging from 2 to 300 Hz.
4. Providing a printed record of each event showing a plot of peak particle velocity versus vibration frequencies.
5. Measuring and recording airblast noise levels. The noise transducer must be detachable from the main unit to allow placing at elevations with a clear line of sight between transducer and blast.

Record each blast shot using approved seismographs and prepare a vibration and noise monitoring report. The report must include:

1. Identification of instruments used
2. Name of blast monitoring consultant
3. Distance and direction of recording stations from blast area
4. Type of ground at recording station and material on which instrument sits
5. Maximum particle velocity in each component and resultant peak particle velocity of each shot
6. Copy of seismograph readings with date and signature of blast monitoring consultant
7. Noise levels recorded in dB (C-network or Linear network) units

19-4.01D(7) Video Recording of Blasts

Video-record each blast. The video-recording must be taken from a safe location with a clear view of the blast area, activities, and progression. Identify each video or section of video with an index to identify each blast. Submit a copy of each video in DVD-Video format.

19-4.01D(8) Blasting Complaints

Accurately document each complaint. Notify the Engineer immediately of a complaint received or at the start of the next day's work shift. Complaint documentation must include:

1. Name and address of complainant
2. Date, time, and nature of complaint
3. Dated photo or videotape of physical damage
4. Name of person receiving complaint
5. Record of complaint investigation conducted
6. Resolution of complaint

19-2.04D(9) Postblast Reports

Document each shot in a postblast report. The postblast report must include all data required in the controlled blasting plan for that shot and the following:

1. Description of site conditions, loading, and time of blast
2. Description of weather conditions at time of blast including wind direction and cloud cover
3. Drillers boring record
4. Copy of vibration and noise monitoring report
5. Copy of documented complaints arising from the blast

Submit the postblast report within 48 hours of the blast.

19-4.02 MATERIALS

Not Used

19-4.03 CONSTRUCTION

At least 7 days before starting or resuming blasting activities, notify occupants of the local buildings within 330 feet of the blasting area in writing. Verbally notify occupants of pending blasting activities on the day of blasting.

Do not perform blasts within 1,200 feet of concrete placed within 72 hours.

Before firing any blast, confirm that groundwater conditions are consistent with shot design and explosive type to be used.

Before firing any blast in areas where flyrock may result in personal injury or damage to property or the work, cover the rock to be blasted with blasting mats, soil, or other equally serviceable material to prevent flyrock.

If blasting causes flyrock, suspend blasting activities. The blasting consultant must review the site to determine the cause of the flyrock problem and provide an amendment to the controlled blasting plan that prevents flyrock.

Do not use drill cuttings as stemming in controlled blasting operations.

19-4.04 PAYMENT

Rock excavation is measured as specified for roadway excavation in section 19-2.04.

Replace the 3rd paragraph in section 19-6.02B with

Backfill placed below the bottom layer of subgrade enhancement geotextile, Class B2 must comply with the requirements in the following 2 tables:

Sieve size	Percent passing
3"	100
3/4"	25
No. 4	0

Property	Contract Compliance	California Test No.
Durability Index (min)	52	229
Apparent Specific Gravity	2.6	206
Sodium Sulfate Soundness of Aggregate I	Maximum 10% weighted average loss	214
Las Angeles Abrasion Test	45% Maximum after 500 revolutions	211

Add to section 19-6.02B:

Backfill placed above the layers of subgrade enhancement geotextile, Class B2 as shown must comply with the requirements in section 26-1.02B. Aggregate grading must comply with 3/4 inch maximum.

Replace section 19-6.03B with:

19-6.03B Subsidence

You may compact the ground surface on which an embankment is to be constructed before placing embankment material.

If the compaction results in an average subsidence exceeding 0.25 foot, the Engineer measures the ground surface after compaction. Allow time for the Engineer to measure the area before placing embankment material.

A quantity of 25,000 cubic yards of embankment will be added to the computed imported borrow quantity for the anticipated effect of subsidence.

If you do not agree with this specified quantity, you may submit a plan for measuring subsidence. The plan must include complete details of the measuring devices and their installation.

If your plan for measuring subsidence is authorized, install and maintain the subsidence-measuring devices.

The Engineer takes readings as needed to determine the progress of subsidence. Provide assistance as needed.

If the Engineer finds that a device has been damaged, that device will not be used for determining subsidence in the area the device represents. The subsidence for that area is considered as zero regardless of the subsidence measured at other areas.

Subsidence is considered as zero at:

1. Intersection of the side slope and end slope at structures with the ground line as established by the original cross-sections

2. Points on the cross-sections 50 feet beyond the start and end of the area with subsidence-measuring devices, unless the Engineer agrees otherwise

The additional quantity of material for embankment work due to subsidence is determined by the average-end-area method from the original measurements and the final measurements, including zero subsidence at specified areas.

After final measurements are made, remove detachable elements of the subsidence-measuring devices.

Replace item 2 in the list in the 1st paragraph of section 19-6.03D with:

2. Entire length of a retaining wall and a width as shown from the face of the wall.

Add to section 19-6.03D:

Settlement platforms are required for roadway embankments as specified in the following table:

Station Location On the "A" Line	Surcharge height (feet)	Settlement period (days)	Test method
135+50	0	30	California Test 112
203+50	0	30	California Test 112
210+00	0	30	California Test 112
260+50	0	60	California Test 112
277+00	0	60	California Test 112
289+50	0	60	California Test 112
296+00	0	60	California Test 112
313+00 @ 35Ft RT	0	60	California Test 112
318+00	0	60	California Test 112

Settlement platforms will be monitored by the Engineer.

Add to section 19-7.02C:

The portion of imported borrow placed within 4 feet of the finished grade must have a resistance (R-Value) of at least 40.

Replace the 2nd and 3rd paragraphs of section 19-7.04 with:

Imported borrow is measured based on planned or authorized cross section for embankments as shown and the measured ground surface.

Quantities of roadway excavation, structure excavation, and ditch excavation which have been used in the embankment will be adjusted by multiplying by a specified grading factor as shown. The Department does not adjust payment if the specified grading factor does not equal the actual grading factor.

The quantity of imported borrow is the quantity remaining after deducting the adjusted quantities from excavations from the total embankment quantity and adding the quantity for subsidence as specified in section 19-6.03B.

20 LANDSCAPE

Replace item 1 in the 5th paragraph of section 20-1.01A of the RSS for section 20 with:

1. Remove trash, debris, weeds and non-native plants within the job site prior to performing other landscape construction work.

Replace the 3 paragraphs in section 20-1.01D(2) of the RSS for section 20 with:

Progress inspections are intermittently performed by the Engineer at various stages of work during the Contract.

Replace the 3rd paragraph in section 20-1.02C of the RSS for section 20 with:

Do not use rodenticides.

Add to section 20-1.02C of the RSS for section 20:

Select herbicides from the following table:

Herbicide name	Herbicides					
	Herbicide type					
	Preemergent (granular)	Preemergent (non-granular)	Post- emergent	Selective	Non- selective	Systemic
Aminopyralid				X		
Chlorsulfuron				X		
Clopyralid MEA					X	
Diquat dibromide					X	
Fluazifop-P-Butyl				X		
Flumioxazin				X		
Glyphosate			X			X
Imazapyr					X	
Rimsulfuron				X		
Sethoxydim			X	X		
Sulfentrazone					X	
Sulfometuron-methyl					X	
Sulfosulfuron					X	
Triclopyr						X

Delete the 3rd paragraph of section 20-1.03A of the RSS for section 20.

Replace item 3 in the 1st paragraph of section 20-1.03C(1) of the RSS for section 20 with:

3. Removing existing plants and thatch as described

Replace the last paragraph of section 20-1.03C(1) of the RSS for section 20 with:

Control rodents by using traps.

Add between the 1st and 2nd paragraphs of section 20-1.03C(2) of the RSS for section 20:

Non-native plants must be killed within the Vessels, Tabata, and Morrison Mitigation job sites. Non-native plants including arundo, tamarisk, pampas grass, mustard, horseweed, castor bean, tree tobacco, fennel and the following grass species (Ehrharta, Bromus, Cynodon, Wild Oat and Wild Rye).

Kill and remove non-native plants by:

1. Removing all seed stalks, flower heads, and above ground plant mass. Removal must comply with the mechanical removal specifications in section 16-1.03A.
2. Removing plant stumps, roots or rhizomes. Removal may be by chemical or mechanical means as follows:
 - 2.1. Mechanical removal must comply with section 16-1.03A.
 - 2.2. Chemical removal includes cutting plants off 2 inches above the ground and applying pesticide immediately (within one minute) to the cut.

Add to section 20-1.03C(2) of the RSS for section 20:

20-1.03C(2)(a) Remove Existing Thatch

Remove existing thatch from erosion control (Type 6) areas. Removal of existing thatch includes removing built-up plant materials, stems, seed heads and seed to expose the soil surface. Existing native plants within erosion control (Type 6) areas must be preserved.

Add to section 20-1.03C(3) of the RSS for section 20:

Control weeds within the highway including medians and surfaced areas such as new and existing pavement, curbs and sidewalks.

Control weeds by hand pulling within plant basins and on basin walls.

Control weeds by hand pulling in sod areas.

Control weeds with spot pesticide treatment within erosion control areas.

Add between the 1st and 2nd paragraphs of section 20-1.03C(4) of the RSS for section 20:

Dispose of removed seed stalks and flower heads from non-native plants the same day they are removed. Dispose of other non-native plant mass within 3 days of removal.

Replace "Reserved" in section 20-1.03E of the RSS for section 20 with:

Do not perform planting work in weed germination areas for a period of 21 days after irrigation systems have been installed.

For weed germination areas, keep the soil sufficiently moist to germinate weeds. Weeds that germinate must be controlled by the use of pesticides.

Replace the 3rd paragraph of section 20-2.01A(4)(b)(i) of the RSS for section 20 with:

Supply lines on the discharge side of the valve must be tested in conformance with Method B only. Testing by Method A is not allowed.

Supply lines installed by trenching and backfilling and supply lines that are completely visible after installation must be tested by Method B.

Replace the last paragraph in section 20-2.01B(7) of the RSS for section 20 with:

Valve box covers must include a plate plastic label with the appropriate controller letter and station number as shown.

Add to section 20-2.01B of the RSS for section 20:

20-2.01B(9) Electrical Conduit

Electrical conduit must comply with section 86-2.05 and be Type 3 unless otherwise shown.

Delete the 7th and 8th paragraphs in section 20-2.01C(2) of the RSS for section 20:

Add to section 20-2.01C(4) of the RSS for section 20:

Seal all holes in valve box covers within the Tabata, Vessels and Morrison mitigation sites with nuts and bolts or an approved sealant.

Delete item 2 in the list in the 1st paragraph of section 20-2.03B(1) of the RSS for section 20.

Replace the 1st item in the 4th paragraph in section 20-2.05B with:

1. Size conductors as recommended by the irrigation controller manufacturer, unless specified otherwise.

Replace section 20-2.07B(2)(a) of the RSS for section 20 with:

20-2.07B(2)(a) General

Irrigation controllers must be Rain Bird 12 station controllers, Model No. ESP12LXME, with 4 and 12 station expansion modules (24, 36, 40 and 48 station controllers).

You may obtain specified equipment listed below from:

Hydro-Scape Products, Incorporated
 5805 Kearny Villa Road
 San Diego, CA 92123
 (858) 560-1600

The Department has obtained quoted prices excluding sales tax and delivery for the equipment shown in the following table:

Equipment Description	Quoted Price	Quantity Each	Extended Price	Controller Identification
Rain Bird 12 Station Irrigation Controller, Model No. ESP12LXME with 1-12 Station Rain Bird Expansion Module, Model No. ESPLXMSM12 (24 Station Total).	\$325.60	3	\$976.80	D, Q and R
Rain Bird 12 Station Irrigation Controller, Model No. ESP12LXME with 2-12 Station Rain Bird Expansion Modules, Model No. ESPLXMSM12 (36 Station Total).	\$440.82	4	\$1,763.28	F, G, H, and L
Rain Bird 12 Station Irrigation Controller, Model No. ESP12LXME with 3-12 Station Rain Bird Expansion Modules, Model No. ESPLXMSM12 (48 Station Total).	\$556.04	6	\$3,336.24	B, C, E, J, K and P

These prices are good until 02/09/2015.

Replace "Reserved" in section 20-2.07B(2)(c) of the RSS for section 20 with:

Solar powered irrigation controllers must be DIG Corporation, LEIT X Series ambient light controllers.

You may obtain specified equipment listed below from:

Hydro-Scape Products, Incorporated
 5805 Kearny Villa Road
 San Diego, CA 92123
 (858) 560-1600

The Department has obtained quoted prices excluding sales tax and delivery for the equipment shown in the following table:

Equipment Description	Quoted Price	Quantity Each	Extended Price	Controller Identification
Leit 24 Station Solar Irrigation Controller, Model No. LEITX24 with 35" Mounting Column, model No. MCOLXS. Includes Mounting Kit, model No. MKIT-X. LEIT Programming Key, Model No. LEITKEY.	\$1,281.24	1	\$1,281.24	S
Leit 28 Station Solar Irrigation Controller, Model No. LEITX28 with 35" Mounting Column, model No. MCOLXS. Includes Mounting Kit, model No. MKIT-X. LEIT Programming Key, Model No. LEITKEY.	\$1,341.24	7	\$9,388.68	U, V, W, X, Y, Z and AA

These prices are good until 02/09/2015.

Delete items 2.1, 2.2 and 2.3 in the list in the 1st paragraph of section 20-2.07B(3) of the RSS for section 20.

Add item 7 in the list in the 1st paragraph in section 20-2.07B(3) of the RSS for section 20 with:

- Have door locks with a removable-core mortise cam cylinder door lock compatible with the Department's lock core. The Department's lock core is a "Best" construction core. Keys must be removable from the locks in the locked position only. Install door locks in conformance with the manufacturer's written instructions and recommendations. Furnish 2 keys for each door lock to the Engineer.

Add to section 20-2.07B(3) of the RSS for section 20:

A single irrigation controller enclosure cabinet must be 36 inches high by 24 inches wide by 12 inches deep.

A double irrigation controller enclosure cabinet must be 36 inches high by 36 inches wide by 12 inches deep.

Add to section 20-2.07B of the RSS for section 20:

20-2.07B(5) Irrigation Controller Enclosures

Irrigation controller enclosures must be as shown, and comply with section 20-2.03B(4).

Add to section 20-2.07C of the RSS for section 20:

Install irrigation controller (solar) on a mounting tube per the manufacturer's recommendations and in an irrigation controller enclosure as shown.

Replace "Reserved" in section 20-2.08B(1) of the RSS for section 20 with:

Caps for conduit ends must be one of the following:

1. A piece of no. 30 asphalt-felt building paper secured with galvanized wire
2. Filter fabric secured with galvanized wire
3. Schedule 40 PVC cap
4. As approved by the Engineer

Add to section 20-2.08C(1) of the RSS for section 20:

Install top of conduits:

1. 18 to 30 inches below the finished surface in sidewalk, driveway and path areas
2. 40 to 52 inches below the finished grade in traveled way areas

Replace the 8th paragraph in section 20-2.08C(1) of the RSS for section 20 with:

Cap the ends of conduit.

Delete the 2nd paragraph in section 20-2.08C(2)(a) of the RSS for section 20:

Replace the 1st paragraph in section 20-2.08C(3) of the RSS for section 20 with:

Schedule 40 pipe conduit may be installed by directional boring under section 20-2.08C(2)(b).

Delete the 2nd and 3rd paragraphs in section 20-2.08C(3) of the RSS for section 20.

Replace the 1st sentence in section 20-2.08D of the RSS for section 20 with:

Not used.

Add to section 20-2.10B(1) of the RSS for section 20:

Threaded nipples for sprinkler assemblies must be schedule 80, PVC 1120 or PVC 1220 pipe and comply with ASTM D 1785.

Fittings for sprinkler assemblies must be injection molded PVC, schedule 40 and comply with ASTM D 2466.

Replace the 1st sentence in section 20-2.10B(3) of the RSS for section 20 with:

Each riser sprinkler assembly must include a body, riser or flexible hose, threaded nipple, swing joint, check valve and nozzle as shown.

Replace the 1st paragraph in section 20-2.10B(4) of the RSS for section 20 with:

Each tree well sprinkler assembly must include a body, riser, swing joint, pea gravel, perforated drainpipe, and drain cap as shown.

Replace the 2nd sentence in the 3rd paragraph of section 20-2.10B(4) of the RSS for section 20 with:

Drain grate must be sand.

Replace the 4th paragraph of section 20-2.10B(4) of the RSS for section 20 with:

Pea gravel for filling the drainpipe must have a maximum diameter of 1/2 inch. Pea gravel must be naturally rounded aggregate, clean, washed, dry and free from clay or organic material.

Add to section 20-2.10B(4) of the RSS for section 20:

The riser must be schedule 80, PVC 1120 or PVC 1220 pipe and comply with ASTM D 1785.

Add to section 20-2.11B(6) of the RSS for section 20:

Pipe flanges used to connect plastic or metal pipe to gate valves must be metal.

Replace item 2 in the list in the 1st paragraph in section 20-2.11B(10)(a) of the RSS for section 20 with:

2. Be brass

Replace item 5 in the list in the 1st paragraph of section 20-2.11B(10)(a) of the RSS for section 20 with:

5. Have one piece solenoids compatible with the irrigation controller, with plunger and spring secured to the solenoid.

Replace item 6 in the list in the 1st paragraph of section 20-2.11B(10)(a) of the RSS for section 20 with:

6. Have an external and internal manual bleed device.

Add to the list in 1st paragraph of section 20-2.11B(10)(a) of the RSS for section 20:

11. Not have external tubing.

Add to section 20-2.11(B) of the RSS for section 20:

20-2.11B(12) Combination Air Release Valve

Combination air release valves (CARV) must perform the functions of both an air release and an air/vacuum valve. Valves must exhaust large quantities of air during the filling of a piping system, close upon liquid entry, and open during draining or if a negative pressure occurs. Valves must release accumulated air from a piping system while the system is in operation and under pressure.

CARV must:

1. Be an automatic float operated valve with a single body.
2. Be constructed of ASTM A126 Class B cast iron.
3. Have a maximum pressure rating of 150 PSI.
4. Have floats, guide shafts, bushings and linkage mechanisms constructed of stainless steel.
5. Have threaded NPT inlets and outlets.
6. Have a hexagonal body inlet connection for a pipe wrench connection.
7. Have two additional NPT connections for the addition of gauges, testing and draining.
8. Have a body cover that bolts to the valve and is sealed with a flat gasket.

Where shown, a full ported brass ball valve must be provided to isolate the CARV from the piping system. Ball valve must comply with section 20-2.11B(2).

Add to section 20-2.11C of the RSS for section 20:

20-2.11C(6) Combination Air Release Valve

Install combination air release valves in valve boxes where shown.

Replace "Reserved" in section 20-2.12 of the RSS for section 20 with:

Water meters for the irrigation systems will be installed by the local water authority. The local water authority is Rainbow Water District.

The local water authority has established a fee of \$85,000 for furnishing and installing each water meter. The fees charged by the local water authority include:

1. Furnishing and installing each water meter

Make arrangements and pay the fees required to install each water meter.

If, at the time of installation, this fee is changed, the Department makes a payment adjustment for the difference in cost. The adjustment is made on the progress payment after the meter is installed.

Submit a copy of the invoice for the fee.

Replace "Reserved" in section 20-2.13 of the RSS for section 20 with:

20-2.13 TEMPORARY WATER METER ASSEMBLY

Temporary water meter assembly includes materials and equipment to be furnished and installed by the local water authority and materials and equipment to be furnished and installed by you, as shown. The local water authority is Rainbow Water District.

Rainbow Water District has established a fee of \$1,700 for furnishing and installing a portion of the temporary water meter assembly. If, at the time of installation, this fee is changed, the Department makes a payment adjustment for the difference in cost. The adjustment is made on the progress payment after the temporary water meter assembly is installed.

Make the arrangements and pay the costs and fees required by the Rainbow Water District. The Rainbow Water District will furnish and install the following:

1. Temporary water meter
2. Backflow preventer
3. Primary pressure reducing valve
4. Connection to servicing utility stand pipe
5. Annual certification for Rainbow Water District backflow preventer

As part of the temporary water meter assembly you will furnish and install the following:

1. Pressure regulating valve. The pressure regulating valve must comply with section 20-2.11B(7).
2. Combination air release valve. The combination air release valve must comply with section 20-2.11B(12).
3. Pipe and fittings must be seamless Red Brass and comply with ASTM B43-09.

Payment for the temporary water meter assembly includes all materials and equipment required to complete the assembly as shown.

Add to section 20-3.01B(2)(a) of the RSS for section 20:

Plants for the Vessels, Tabata and Morrison Mitigation sites must be grown from parent stock which originated from within San Diego or Orange Counties.

Replace item 2 in the list in the 2nd paragraph of section 20-3.01B(2)(b)(iii) of the RSS for section 20 with:

2. 24 to 36 inches in length

Add to the 1st paragraph of section 20-3.01B(2)(c) of the RSS for section 20:

6. Be grown on a biodegradable net or mesh.

Add to section 20-3.01C(1) of the RSS for section 20:

After planting is complete, equipment and automobiles within the Vessels Mitigation job site must remain on the dirt paths as shown.

Add to section 20-3.01C(3) of the RSS for section 20:

For plants planted within areas watered by an overhead irrigation system, the watering of these plants must occur between the hours of 10:00 PM and 6:00 AM within a maximum of 20 days after the plants have been planted.

Replace item 2 in the 1st paragraph of section 20-3.02A(3) of the RSS for section 20 with:

2. Maintaining existing planted areas. The work plan must include weed control, fertilization (excluding areas within the Vessels Mitigation job site), watering, and controlling rodents and pests.

Replace the 2nd paragraph of section 20-3.02A(4) of the RSS for section 20:

Deficiencies requiring corrective action within the Vessels Mitigation job site include:

1. Weeds
2. Other deficiencies needing corrective action to promote healthy plant life
3. Rodents and pests

Deficiencies requiring corrective action within other job site areas include:

1. Weeds
2. Dead, diseased, or unhealthy plants
3. Missing plant stakes and tree ties
4. Inadequate plant basins and basin mulch
5. Other deficiencies needing corrective action to promote healthy plant life
6. Rodents and pests

Replace the 1st paragraph of section 20-3.02B of the RSS for section 20 with:

Pesticide must comply with section 20-1.02C.

Add between the 1st and 2nd paragraphs of section 20-3.02C(4) of the RSS for section 20:

Control rodents and pests under sections 20-1.03B and 20-1.03C(1).

Control weeds under section 20-1.03C(3).

Control weeds by:

1. Hand pulling in plant basins and on basin walls
2. Killing in erosion control and planting areas outside of plant basins with spot pesticide treatment

Dispose of weeds under section 20-1.03C(4).

Add to the 3th paragraph in section 20-3.03C(3)(d)(ii) of the RSS for section 20:

Plant willow cuttings between December 1 and February 27.

Replace the 5th paragraph in section 20-3.03C(3)(d)(ii) of the RSS for section 20 with:

Plant the base of the cutting from 12 to 16 inches deep and have from 3 to 5 bud scars exposed above the ground. If more than 5 bud scars are exposed, remove the excess scars by pruning.

Replace the 2nd paragraph in section 20-3.03C(3)(e) of the RSS with:

Grade areas to receive sod 1 inch below the finished elevations of all surfaces adjacent to the sod, after fine grading, rolling, and settlement of the soil.

Add to section 20-4.01A of the RSS for section 20:

The plant establishment period must be Type 2.

Within the Vessels Mitigation job site motorized equipment and automobiles must remain on the dirt paths as shown.

Replace the 2nd paragraph in section 20-4.01A of the RSS for section 20 with:

Plant establishment consists of caring for the plants and erosion control, including watering, fertilizing, pruning, replacing damaged plants, pest control, and operating and repairing of all existing irrigation facilities used and irrigation facilities installed as part of the new irrigation system.

Replace the 1st paragraph in section 20-4.01C(1) of the RSS for section 20 with:

Submit the following seasonal watering schedules, March through May, June through August, September through October, and November through February, for use during the plant establishment period. Submit the first seasonal watering schedule within 10 days after the start of the plant establishment period. Subsequent seasonal schedules must be submitted within 5 days of the beginning of each seasonal period.

Add before the 1st paragraph in section 20-4.01D of the RSS for section 20:

You or the supervisor you assign must meet the Engineer at the project site once a month to evaluate the progress of the plant establishment work.

Add to section 20-4.02 of the RSS for section 20:

20-4.02C Pesticides

Pesticide must comply with section 20-1.02C.

Add between the 1st and 2nd paragraphs of section 20-4.03A of the RSS for section 20:

Plant establishment areas must be kept in a neat and presentable condition at all times.

Replace the 3rd paragraph in section 20-4.03A of the RSS for section 20 with:

Turf areas are not required to be trimmed and mowed.

Replace section 20-4.03D of the RSS for section 20 with:

20-4.03D Weed and Non-Native Plant Control

Control non-native plants under section 20-1.03C(2).

Control weeds under section 20-1.03C(3).

Weeds and non-native plants must not exceed 10 percent of the total vegetative cover within the Vessels, Tabata, and Morrison Mitigation job site areas.

Add to section 20-4.03D of the RSS for section 20:

Dispose of weeds under section 20-1.03C(4).

Add to section 20-4.03G of the RSS for section 20:

Seasonal watering schedules must be entered into the irrigation controllers by the Contractor.

All overhead irrigation must be watered between the hours of 10:00 PM and 6:00 AM.

Add to section 20-4.03 of the RSS for section 20:

20-4.03H Pest Control

Control pests under sections 20-1.03B and 20-1.03C(1).

Replace the paragraphs in section 20-5.03D(1)(d) of the RSS for section 20 with:

Test plots are not required.

Replace item 1 in the list in the 1st paragraph of section 20-5.03D(2)(a) of the RSS for section 20 with:

1. Uniform gold color within the park and ride lot and uniform tan color in the wild animal crossings.

Add to section 20-5.03D(2)(a) of the RSS for section 20:

Do not use the following materials:

1. Soil sterilant
2. Filter fabric

Replace the paragraph in section 20-5.03D(2)(b) of the RSS for section 20 with:

Solidifying emulsion is not required.

Replace the second paragraph in section 20-5.03E(2)(a) of the RSS for section 20 with:

Do not use the following materials:

1. Soil Sterilant
2. Filter Fabric

Add to the beginning of section 20-5.03E(3) of the RSS for section 20:

Excavation is not required.

Replace Reserved section 20-5.03F of the RSS for section 20 with:

20-5.03F Rock Mulch

20-5.03F(1) General

20-5.03F(1)(a) Summary

Section 20-5.03F includes specifications for placing rock mulch.

20-5.03F(1)(b) Submittals

Five business days before delivery of the materials to the job site, submit:

1. 10-lb sample of each type of rock mulch

20-5.03F(2) Materials

20-5.03F(2)(a) General

Rock mulch of the types listed below is required at various locations as shown:

1. Rock Mulch (Type1)
2. Rock Mulch (Type 2)
3. Rock Mulch (Type 3)

Rock mulch must be:

1. Clean and free from vegetable matter and other deleterious substances
2. From one source only

20-5.03F(2)(b) Rock Mulch

Rock for rock mulch (Type 1) and (Type 2) must:

1. Vary in size between 3 inches to 8 inches
2. Be mostly tan colored and include a variety of colors including red, brown, gray, light gray and tan, closely resembling "Arizona River Rock," available from KRC Rock, Southwest Boulder & Stone, or Decorative Stone Solutions.

Sprinkle 1/2" to 1-1/2" size rounded pebbles matching the color of the larger size rock over the surface of the rock mulch (Type 2) at a rate of 2 cubic feet per 100 square feet of rock mulch area.

Rock for rock mulch (Type 3) must:

1. Vary in size between 1/2 inch to 3 inches
2. Be mostly tan, and include a variety of colors including red, brown, gray, light gray and tan, closely resembling "Arizona River Rock," available from KRC Rock, Southwest Boulder & Stone, or Decorative Stone Solutions.

20-5.03F(3) Construction

20-5.03F(3)(a) General

Prior to beginning rock mulch work, areas to receive rock mulch must be cleared in conformance with section 20-7.03B.

20-5.03F(3)(b) Rock Mulch

Do not place rock mulch during rainy conditions.

The finished rock mulch surface must be smooth and uniform, maintaining original flow lines, slope gradients, and contours of the job site.

20-5.03F(4) Payment

Rock mulch is measured parallel to the rock mulch surface.

Replace the 1st paragraph of section 37-3.03C(5)(a) with:

Use a continuous self-loading mixing machine except you may use truck mounted mixer spreaders on any of the following:

1. Radii
2. Side streets
3. Gore areas
4. Areas requiring hand work

AA

39 HOT MIX ASPHALT

Replace section 39 with:

39 HOT MIX ASPHALT, SUPERPAVE

39-1.01 GENERAL

39-1.01A Summary

Section 39 includes specifications for producing and placing HMA by mixing aggregate and asphalt binder at a mixing plant and spreading and compacting the HMA mixture.

Section 39 includes specifications for producing and placing WMA by mixing aggregate, asphalt binder and a warm mix technology at a mixing plant and spreading and compacting the WMA mixture.

You may produce HMA-SP (Type A) or RHMA-SP-G using an authorized warm mix asphalt (WMA) technology. For Department-authorized WMA technologies, go to the METS Web site

HMA includes one or more of the following types:

1. HMA, superpave (HMA-SP) Type A
2. RHMA, superpave, gap graded (RHMA-SP-G)
3. OGFC including HMA-O, and RHMA-O

The RSSs for section 39 do not apply

39-1.01B Definitions

coarse aggregate: Aggregate retained on a 1/4-inch screen

fine aggregate: Aggregate passing the 1/4-inch screen.

leveling course: Thin layer of HMA used to correct minor variations in the longitudinal and transverse profile of the pavement before placement of other pavement layers.

lower course: HMA-SP (Type A) layers below 0.2 feet from finished grade

miscellaneous areas: Areas outside the traveled way such as:

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

modified binder: PG graded binder designated as polymer modified (PM) or terminal blend (TR), or any PG grade binder with rubber modifiers.

processed RAP: RAP that has been fractionated.

substitution rate: Amount of RAP aggregate substituted for virgin aggregate in percent.

supplemental fine aggregate: Aggregate passing the no. 30 sieve, including hydrated lime, portland cement, and fines from dust collectors.

surface course: Upper 0.2 feet of HMA-SP (Type A) exclusive of HMA-O or RHMA-O.

top layer: Final riding surface exclusive of HMA-O or RHMA-O.

WMA: HMA produced at temperatures no greater than 275 degrees F.

HMA with WMA technology: HMA produced using additives to aid with mixing and compaction of HMA produced at temperatures greater than 275 degrees F.

39-1.01C Submittals

39-1.01C(1) General

For miscellaneous areas and dikes, a JMF submittal is not required. For OGFC, submit a complete JMF submittal, except for asphalt binder content. The Department determines the asphalt binder content under California Test 368 within 20 days of your complete JMF submittal and provides you a *Caltrans Hot Mix Asphalt Verification* form.

For JMF mix design, JMF verification, production start-up, and each 10,000 tons, submit AASHTO T 283 and AASHTO T 324 (Modified) test results to the Engineer and electronically to:

Moisture_Tests@dot.ca.gov

At production start-up and within 1000 tons of the halfway point of production of HMA, submit samples split from your HMA production sample for AASHTO T 283 and AASHTO T 324 (Modified) tests to the Engineer and the Transportation Laboratory, Attention: Moisture Test.

Submit all completed quality control test results within 3 business days of a request. Submit all quality control tests except AASHTO T 283 within 7 days of a request. Submit AASHTO T 283 quality control tests within 14 days of a request.

For tests performed under AASHTO T324 (Modified) as specified in section 39-1.01D(1), submit test data and 1 tested sample set within 3 business days of sampling.

Submit a new JMF if you change any of the following:

1. Target asphalt binder percentage greater than ± 0.2 percent
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. WMA
8. LAS producer
9. Any material in the JMF

Submit a new JMF when the average binder content in a new fractionated RAP stockpile is more than ± 2.0 percent from the average binder content of the original fractionated RAP stockpile used in the mix design.

Submit a new JMF when the processed RAP specific gravity is more than ± 0.060 from the average maximum specific gravity reported on page 4 of your *Contractor Hot Mix Asphalt Design Data* form.

39-1.01C(2) Job Mix Formula

39-1.01C(2)(a) General

For each type of HMA shown, submit your proposed JMF on the *Contractor Job Mix Formula Proposal* form along with:

1. Mix design documentation on *Hot Mix Asphalt Design Data* form dated within 12 months of submittal
3. JMF verification on a *Caltrans Hot Mix Asphalt Verification* form, if applicable
3. JMF renewal on a *Caltrans Job Mix Formula Renewal* form, if applicable
4. MSDS for:
 - 4.1. Asphalt binder
 - 4.2. Base asphalt binder used in asphalt rubber binder
 - 4.3. CRM and asphalt modifier used in asphalt rubber binder
 - 4.4. Blended asphalt rubber binder mixture
 - 4.5. Supplemental fine aggregate except fines from dust collectors
 - 4.6. Antistrip additives
 - 4.7. WMA technology
5. For RHMA-G-SP, asphalt rubber binder design and profile. The JMF must be based on a HMA mix design determined as described in the *Superpave Mix Design SP-2 Manual* by the Asphalt Institute

39-1.01C(2)(b) Mix Design

The HMA mix design must comply with AASHTO R 35 except:

1. Notes 3, 6, and 10 do not apply
2. AASHTO M 323 does not apply on combinations of aggregate gradations and asphalt binder contents to determine the OBC and HMA mixture qualities

For HMA with WMA additive technology, produce HMA mix samples for your mix design using your methodology for inclusion of WMA admixture in laboratory produced HMA. For WMA water injection foam technology, the use of foamed asphalt for mix design is not required.

Your *Hot Mix Asphalt Design Data* form must show documentation on aggregate quality.

For HMA mixtures utilizing RAP the maximum binder replacement is 25.0 percent for surface course and 40.0 percent for lower courses.

For HMA with a binder replacement percent less than or equal to 25 percent of optimum binder content, you may request that the performance graded asphalt binder grade with upper and lower temperature classifications be reduced by 6 degrees C from the specified grade.

For HMA with a binder replacement greater than 25 percent of optimum binder content and less than or equal to 40 percent of optimum binder content, you must use a performance graded asphalt binder grade with upper and lower temperature classifications reduced by 6 degrees C from the specified grade.

The mix design must comply with the quality characteristics of the following table:

Hot Mix Asphalt Mix Design Requirements

Quality characteristic	Test method	HMA-SP	
		Type A	RHMA-SP-G
Air voids content (%) ^a	AASHTO T 269 ^a	N _{initial} >8.0 N _{design} = 4.0 N _{max} >2.0	N _{design} Specification
Air voids content (%) ^a 1" gradings	AASHTO T 269 ^a	N _{initial} >8.0 N _{design} = 5.0 N _{max} >2.0	--
Gyrations Compaction (number of gyrations)	AASHTO T 312	N _{initial} 8 N _{design} 85 N _{max} 130	N _{design} 50–150 ^b
Voids in mineral aggregate (% min.) 1/4" grading 3/8" grading 1/2" grading 3/4" grading 1" grading with NMAS=1" with NMAS=3/4"	SP-2 Asphalt Mixtures Volumetrics ^c	16.5-19.5 15.5-18.5 14.5-17.5 13.5-16.5 13.5-16.5 14.5-17.5	-- -- 18.0–23.0 18.0–23.0
Dust proportion 1/4" and 3/8 gradings 1/2" and 3/4" gradings 1" grading	SP-2 Asphalt Mixtures Volumetrics ^c	0.6–1.3 0.6–1.3 0.6–1.3	Report Only
Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) PG 58 PG 64 PG-70 PG-76 or higher	AASHTO T 324 (Modified) ^{d,e}	10,000 15,000 20,000 25,000	15,000 20,000 25,000
Hamburg wheel track (inflection point minimum number of passes) PG 58 PG 64 PG-70 PG-76 or higher	AASHTO T 324 (Modified) ^{d,e}	10,000 10,000 12,500 15,000	10,000 10,000 12,500
Moisture susceptibility (minimum dry strength, psi)	AASHTO T 283 ^{d,f}	100	100
Moisture susceptibility (minimum wet strength, psi)	AASHTO T 283 ^{d,f,g}	70	70

^aCalculate the air voids content of each specimen using AASHTO T 275 to determine bulk specific gravity AASHTO T 209 Method A to determine theoretical maximum specific gravity. Under AASHTO T 209 use a digital monometer and pycnometer when performing AASHTO T 209.

^bSuperpave gyratory compactor ram pressure may be increased to a maximum of 825kPa, and specimens may be held at a constant height for a maximum of 90 minutes.

^cMeasure bulk specific gravity using AASHTO T 275.

^dTest plant produced HMA.

^eTest as specified in section 39-1.01D(1).

^fTest specimens must be 100mm or 150mm gyratory compacted HMA

^gFreeze thaw required

If the test results for AASHTO T 283 or AASHTO T 324 (Modified) for untreated plant produced HMA is less than minimum requirements for HMA-mix design, determine the plasticity index of the aggregate blend under California Test 204. The antistrip treatment must be based on plasticity index in compliance with the following table:

Hot Mix Asphalt Antistrip Treatment Options

Quality characteristic	Test method	Treatment requirement
Plasticity index Plasticity index from 4 to 10 ^a	California Test 204	Dry hydrated lime with marination Lime slurry with marination
Plasticity index less than 4		Liquid Dry hydrated lime without marination Dry hydrated lime with marination Lime slurry with marination

^aIf the plasticity index is greater than 10, do not use that aggregate blend.

If the tensile strength test result for treated plant produced RHMA-SP-G is less than the RHMA-SP-G mix design requirement for tensile strength, the minimum tensile strength requirement is waived, but you must use any of the following antistrip treatments:

1. HMA aggregate lime treatment – slurry method
2. HMA aggregate lime treatment – dry lime method
3. Liquid antistrip treatment using 0.5 to 1.0 percent liquid antistrip

39-1.01C(2)(c) Job Mix Formula Document Review

Allow the Engineer 5 business days from a complete JMF submittal, for document review of the aggregate qualities, mix design, and JMF. Do not start HMA production before verification and acceptance of JMF.

39-1.01C(2)(d) Job Mix Formula Verification

If you cannot submit a Department-verified JMF on a *Caltrans Hot Mix Asphalt Verification* form dated within 12 months before HMA production, the Engineer verifies the JMF.

For OGFC, the Engineer determines the asphalt binder content under California Test 368 within 20 days of your complete JMF submittal and provides you a *Hot Mix Asphalt Verification* form.

HMA produced with WMA technology for JMF verification must be produced using the WMA technology shown in the JMF submittal.

Based on your testing and production experience, you may submit an adjusted aggregate gradation TV on a *Contractor Job Mix Formula Proposal* form before verification testing. Aggregate gradation TV must be within the TV limits specified in the aggregate gradation tables.

Asphalt binder set point for HMA verification must be the OBC specified on your *Contractor Hot Mix Asphalt Design Data* form. When RAP is used, asphalt binder set point for HMA must be:

$$\text{Asphalt Binder Set Point} = \frac{\frac{BC_{OBC}}{\left(1 - \frac{BC_{OBC}}{100}\right)} - R_{RAP} \left[\frac{BC_{RAP}}{\left(1 - \frac{BC_{RAP}}{100}\right)} \right]}{100 + \frac{BC_{OBC}}{\left(1 - \frac{BC_{OBC}}{100}\right)}}$$

Where:

BC_{OBC} = optimum asphalt binder content, percent based on total weight of mix

R_{RAP} = RAP ratio by weight of aggregate

BC_{RAP} = asphalt binder content of RAP, percent based on total weight of RAP mix

For HMA, the Engineer verifies the JMF from samples taken from HMA produced by the plant to be used. Notify the Engineer at least 2 business days before sampling materials.

In the Engineer's presence and from the same production run, take samples of:

1. Aggregate – Coarse, fine, and supplemental fine aggregate from cold feed belts, or hot bins. Samples must include at least 120 lbs for each coarse aggregate, 80 lbs for each fine aggregate, and 10 lbs for each type of supplemental fines. The Department combines these aggregate samples to comply with the JMF TVs submitted on a *Contractor Job Mix Formula Proposal* form.
2. Asphalt binder - 2 quarts minimum 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.
3. RAP - From the RAP system. Samples must be at least 50 lbs minimum.
4. HMA - 250 lbs minimum.

Sample aggregate from cold feed belts or hot bins.

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 parts to the Engineer and use 1 part for your testing.

After completion of the JMF document review, the Engineer verifies each proposed JMF within 20 days of receiving all verification samples and the JMF document submittal has been accepted. If you request, the Engineer verifies RHMA-G quality requirements within 7 days of receiving all verification samples, and the JMF document submittal has been accepted. 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 1.5 percent)
 - 4.2. VMA (minimum HMA mix design requirement 12.5-15.5)
 - 4.3. Dust proportion (0.6-1.3)

To verify the JMF air voids content the Engineer uses an average of three briquettes for air voids content, VMA, and dust proportion. The Engineer tests plant produced material.

If the Engineer verifies the JMF, the Engineer provides you a *Hot Mix Asphalt Verification* form.

If the Engineer's tests on plant-produced samples do not verify the JMF, the Engineer notifies you and you must submit a new JMF or submit an adjusted JMF based on your testing. JMF adjustments may include a change in:

1. Asphalt binder content target value up to ± 0.2 percent from the OBC value submitted on *Hot Mix Asphalt Design Data* form except do not adjust the target value for asphalt rubber binder for RHMA-G-SP below 7.5 percent by total weight of mixture.
2. Aggregate gradation target values within the target value limits specified in the aggregate gradation table.

You may adjust the JMF only once due to a failed verification test. An adjusted JMF requires a new *Contractor Job Mix Formula Proposal* form and *Hot Mix Asphalt Design Data* form 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 less than 12 months old.

For each HMA type and aggregate size specified, the Engineer verifies up to 2 proposed JMF submittals including a JMF adjusted after verification failure. If you submit more than 2 JMF for each type of HMA and aggregate size, 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.

If you have a verified *Hot Mix Asphalt Verification* form, the Engineer will verify 1 binder source change for each HMA type and aggregate size specified. The Engineer deducts \$2,000 from payments for this verification. This deduction does not apply to verifications initiated by the Engineer or JMF renewal.

39-1.01C(2)(e) Job Mix Formula Renewal

You may request a JMF renewal by submitting:

1. Proposed JMF on a *Contractor Job Mix Formula Proposal* form
2. Previously verified JMF documented on a *Caltrans Hot Mix Asphalt Verification* form dated within 12 months
3. Mix design documentation on a *Contractor Hot Mix Asphalt Design Data* form used for the previously verified JMF

If the Engineer requests, sample the following materials in the presence of the Engineer and place in labeled containers weighing no more than 50 lbs each:

1. Coarse, fine, and supplemental fine aggregate from cold feed belts, or hot bins. Samples must include at least 120 lbs for each coarse aggregate, 80 lbs for each fine aggregate, and 10 lbs for each type of supplemental fines. The Department combines these aggregate samples to comply with the JMF TVs submitted on a *Contractor Job Mix Formula Proposal* form.
2. RAP from the RAP system. Samples must be at least 50 lbs.
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 at least 2 business days before sampling materials. For aggregate, RAP, and HMA, split samples into at least 4 parts. Submit 3 parts to the Engineer and use 1 part for your testing.

Allow the Engineer 5 business days from a complete JMF re-verification submittal for document review of the aggregate qualities, mix design, and JMF. Do not start HMA production before re-verification and acceptance of JMF.

The most recent aggregate quality test results within the past 12 months may be used for verification of JMF renewal or the Engineer may perform aggregate quality tests for verification of JMF renewal.

The Engineer verifies the JMF under section 39-1.01C(2)(d) except:

1. Engineer retains samples until you provide test results for your part on a *Contractor Job Mix Formula Renewal* form.
2. Department tests samples of materials obtained from the HMA production unit after you submit test results that comply with the specifications for the quality characteristics in section 39-1.01C(2)(b).
3. After completion of the JMF re-verification document review, 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 Department's expense 1 proposed JMF renewal within a 12-month period.

If the Engineer verifies the JMF renewal, the Engineer provides you a *Caltrans Hot Mix Asphalt Verification* form.

39-1.01C(2)(f) 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

39-1.01C(2)(g) Job Mix Formula Modification

For an accepted JMF, you may change asphalt binder source or liquid antistriper producer one time during production.

Submit your modified JMF request a minimum of 10 business days before production. Each modified JMF submittal must consist of:

1. Proposed modified JMF on *Contractor Job Mix Formula Proposal* form, marked "Modified."
2. Mix design records on *Contractor Hot Mix Asphalt Design Data* form for the accepted JMF to be modified.
3. JMF verification on *Hot Mix Asphalt Verification* form for the accepted JMF to be modified.
4. Quality characteristics test results for the modified JMF as specified in section 39-1.01C(2)(b).
Perform tests at the mix design OBC as shown on the Contractor Asphalt Mix Design Data form.

With an accepted modified JMF submittal, the Engineer verifies each modified JMF within 7 business days of receiving all verification samples.

The Engineer verifies the modified JMF after the modified JMF HMA is placed on the project and verification samples are taken within the first 750 tons following sampling requirements in section 39-1.01C(2)(d). The Engineer tests verification samples for compliance with:

1. Hamburg Wheel Track as shown in the table titled "HMA Mix Design Requirements"
2. Air void content at design value ± 1.5 percent
3. Voids in mineral aggregate as shown in the table titled "HMA Mix Design Requirements"
5. Dust proportion, as shown in the table titled "HMA Mix Design Requirements"

The Engineer may test for moisture susceptibility, as shown in the table titled "HMA Mix Design Requirements"

If the modified JMF is verified, the Engineer revises your *Hot Mix Asphalt Verification* form to include the new asphalt binder source or new liquid antistriper producer. Your revised form will have the same expiration date as the original form.

If a modified JMF is not verified, stop production and any HMA placed using the modified JMF is rejected.

The Engineer deducts \$2,000 from payments for each modified JMF verification. The Engineer deducts an additional \$2,000 for each modified JMF verification that the Engineer tests for moisture susceptibility.

39-1.01C(2)(h) Warm Mix Asphalt

If WMA technology is used, submit the following with your proposed JMF submittal:

1. MSDS for WMA technology
2. For WMA water injection foam technology:
 - 2.1. Name of technology
 - 2.2. Laboratory Procedure LP-12 test result for foamed bitumen expansion ratio dated within 12 months of submittal
 - 2.3. Laboratory Procedure LP-12 test result for foamed bitumen half-life dated within 12 months of submittal
 - 2.4. Optimum foaming water content
 - 2.5. Proposed HMA production temperature range

3. For WMA additive technology:
 - 3.1. Name of technology
 - 3.2. Percent admixture by weight of binder and percent admixture by total weight of HMA as recommended by the manufacturer
 - 3.3. Methodology for inclusion of admixture in laboratory-produced HMA
 - 3.4. Proposed HMA production temperature range

The HMA PPC must produce an electronic log of production data consisting of a series of snapshots captured at a maximum of 1-minute intervals throughout daily production. Each snapshot of production data must be a register of production activity at that time and not a summation of the data over the preceding interval to the previous snapshot. The amount of material represented by each snapshot is the amount produced during the 0.5-minute interval before and the 0.5-minute interval after the capture time. Collect and hold data for the duration of the contract and submit the electronic media, daily and upon request. The snapshot of production data must include the following:

1. Date of production
2. Production location
3. Time of day the data is captured
4. HMA mix type being produced and target binder rate
5. HMA additive type, brand, and target rate
6. Temperature of the binder and HMA mixture
7. For a continuous mix operation, the rate of flow of the dry aggregate calculated from the wet aggregate flow rate as determined by the conveyor scale
8. For a continuous mix plant operation, the rate of flow of the asphalt meter
9. For a continuous mix plant operation, the rate of flow of HMA additive meter
10. For a batch plant operation, actual batch weights of all ingredients
11. Dry aggregate to binder ratio calculated from metered ingredient output
12. Dry aggregate to HMA additive ratio calculated from metered output

At the end of each day's production shift submit electronic and printed media. Present data on electronic media in comma-separated values (CSV) or tab-separated values (TSV) format. Captured data, for the ingredients represented by production snapshot, must have allowances for sufficient fields to satisfy the amount of data required by these specifications and include data titles at least once per report.

39-1.01C(2)(i) Liquid Antistrip Treatment

If liquid antistrip (LAS) treatment is used, submit the following with your proposed JMF submittal:

1. MSDS for LAS.
2. One 1-pint sample.
3. Infrared analysis including copy of absorption spectra.
4. Certified copy of test results and an MSDS for each LAS lot.
5. Certificate of compliance for each LAS shipment. With each certificate of compliance, include:
 - 5.1. Your signature and printed name.
 - 5.2. Shipment number
 - 5.3. Material type.
 - 5.4. Material specific gravity
 - 5.5. Refinery.
 - 5.6. Consignee.
 - 5.7. Destination.
 - 5.8. Quantity.
 - 5.9. Contact or purchase order number.
 - 5.10. Shipment date
6. Proposed proportions for LAS. If you change the brand or type of LAS, submit a new JMF.

For each job site delivery of LAS, submit one 1/2-pint sample to METS. Submit shipping documents. Label each LAS sampling container with:

1. LAS type
2. Application rate
3. Sample date
4. Contract number

At the end of each day's production shift, submit production data in electronic and printed media. Present data on electronic media in tab delimited format. Use line feed carriage return with 1 separate record per line for each production data set. Allow sufficient fields for the specified data. Include data titles at least once per report. For each mixing operation type, submit the following items in order:

1. Batch mixing:
 - 1.1. Production date
 - 1.2. Time of batch completion
 - 1.3. Mix size and type
 - 1.4. Each ingredient's weight
 - 1.5. Asphalt binder content as a percentage of the total weight of mix
 - 1.6. LAS content as a percentage of the asphalt binder weight
2. Continuous mixing
 - 2.1. Production date
 - 2.2. Data capture time
 - 2.3. Mix size and type
 - 2.4. Flow rate of wet aggregate collected directly from the aggregate weigh belt
 - 2.5. Aggregate moisture content as percentage of the dry aggregate weight
 - 2.6. Flow rate of asphalt binder collected from the asphalt binder meter
 - 2.7. Flow rate of LAS collected from the LAS meter
 - 2.8. Asphalt binder content as percentage of the total weight of mix calculated from:
 - 2.8.1. Aggregate weigh belt output
 - 2.8.2. Aggregate moisture input
 - 2.8.3. Asphalt binder meter output
 - 2.9. LAS content as percentage of the asphalt binder weight calculated from:
 - 2.9.1. Asphalt binder meter output
 - 2.9.2. LAS meter output

39-1.01C(2)(j) Lime Treatment

If aggregate lime treatment is used, submit the following with your proposed JMF:

1. Exact lime proportions for fine and coarse virgin aggregate with the proposed JMF
2. If marination is required, the averaged aggregate quality test results within 24 hours of sampling
3. For dry lime aggregate treatment, a treatment data log from the dry lime and aggregate proportioning device in the following order:
 - 3.1. Treatment date
 - 3.2. Time of day the data is captured
 - 3.3. Aggregate size being treated
 - 3.4. HMA type and mix aggregate size
 - 3.5. Wet aggregate flow rate collected directly from the aggregate weigh belt
 - 3.6. Aggregate moisture content, expressed as a percent of the dry aggregate weight
 - 3.7. Flow rate of dry aggregate calculated from the flow rate of wet aggregate
 - 3.8. Dry lime flow rate
 - 3.9. Lime ratio from the accepted JMF for each aggregate size being treated
 - 3.10. Lime ratio from the accepted JMF for the combined aggregate
 - 3.11. Actual lime ratio calculated from the aggregate weigh belt output, the aggregate moisture input, and the dry lime meter output, expressed as a percent of the dry aggregate weight
 - 3.12. Calculated difference between the authorized lime ratio and the actual lime ratio
4. For lime slurry aggregate treatment, a treatment data log from the slurry proportioning device in the following order:
 - 4.1. Treatment date
 - 4.2. Time of day the data is captured
 - 4.3. Aggregate size being treated
 - 4.4. Wet aggregate flow rate collected directly from the aggregate weigh belt
 - 4.5. Moisture content of the aggregate just before treatment, expressed as a percent of the dry aggregate weight

- 4.6. Dry aggregate flow rate calculated from the wet aggregate flow rate
- 4.7. Lime slurry flow rate measured by the slurry meter
- 4.8. Dry lime flow rate calculated from the slurry meter output
- 4.9. Authorized lime ratio for each aggregate size being treated
- 4.10. Actual lime ratio calculated from the aggregate weigh belt and the slurry meter output, expressed as a percent of the dry aggregate weight
- 4.11. Calculated difference between the authorized lime ratio and the actual lime ratio
- 4.12. Dry lime and water proportions at the slurry treatment time

Each 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 1 line. The reported data must include data titles at least once per report.

39-1.01C(3) Asphalt Rubber Binder

For the asphalt rubber binder used, submit:

1. Log of production daily.
2. Certificate of compliance with test results for CRM and asphalt modifier with each truckload delivered to the HMA plant. The certificate of compliance for asphalt modifier must represent no more than 5,000 lbs.
3. Submit certified weight slips for the CRM and asphalt modifier furnished.

Submit a certificate of compliance for the asphalt rubber binder. With the certificate of compliance, submit test results 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 lbs.

39-1.01C(4) Reclaimed Asphalt Pavement

Submit QC test results for RAP gradation with the combined aggregate gradation within 2 days of taking RAP samples during HMA-SP (Type A) and production.

39-1.01C(5) Quality Control Plan

With your proposed JMF submittal, submit a QC plan for HMA. The QC plan must describe the organization and procedures for:

1. Controlling HMA quality characteristics
2. Obtaining samples, including sampling locations
3. Establishing, implementing, and maintaining QC
4. Determining when corrective actions are needed
5. Implementing corrective actions
6. Taking samples, including location of sampling

The QCP must address the elements affecting HMA quality including:

1. Aggregate
2. Asphalt binder
3. Additives
4. Production
5. Paving

The QC plan must include aggregate quality control sampling and testing during lime treatment.

The Engineer reviews the QC plan within 5 business days from the submittal. Do not start HMA production until the Engineer authorizes the plan.

If QC procedures, personnel, tester qualifications, or lab accreditation status change, submit a QC plan supplement at least 3 business days before implementing proposed changes.

39-1.01C(6) Inertial Profiler

At least 5 business days before start of initial profiling or changing profiler or operator, submit:

1. IP certification issued by the Department. The certification must be not more than 12 months old.
2. Operator certification for the IP issued by the Department. The operator must be certified for each different model of IP device operated. The certification must be not more than 12 months old.
3. List of manufacturer's recommended test procedures for IP calibration and verification.

As an alternative to the IP and operator certification by the Department, an equivalent certification from the Texas Transportation Institute will be accepted if the certification is dated before July 1, 2013 and is not more than 12 months old.

Within 2 business days after cross correlation testing, submit ProVAL profiler certification analysis report for cross correlation test results performed on test section to the Engineer and to the electronic mailbox address:

smoothness@dot.ca.gov

Within 2 business days after each day of inertial profiling, submit profile data to the Engineer and to the electronic mailbox address:

smoothness@dot.ca.gov

The profiling data must include:

1. Raw profile data for each lane.
2. ProVAL ride quality analysis report for IRIs of left and right wheel paths of each lane. Submit in pdf file format.
3. ProVAL ride quality analysis report for MRIs of each lane. Submit in pdf file format.
4. ProVAL smoothness assurance analysis report for IRIs of left wheel path. Submit in pdf file format.
5. ProVAL smoothness assurance analysis report for IRIs of right wheel path. Submit in pdf file format.
6. GPS data file for each lane in GPS exchange. Submit in GPS eXchange file format.
7. Manufacturer's recommended IP calibration and verification tests results.
8. AASHTO IP calibration and verification test results including bounce, block, and distance measurement instrument (DMI).

Submit the raw profile data in unfiltered electronic pavement profile file (PPF) format. Name the PPF file using the following naming convention:

YYYYMMDD_TTCCRRR_D_L_W_S_X_PT.PPF

where:

YYYY = year

MM = Month, leading zero

DD = Day of month, leading zero

TT = District, leading zero

CCC = County, 2 or 3 letter abbreviation as shown in section 1-1.08

RRR = Route number, no leading zeros

D = Traffic direction as NB, SB, WB, or EB

L = Lane number from left to right in direction of travel

W = Wheel path as "L" for left, "R" for right, or "B" for both

S = Beginning station to the nearest foot (i.e., 10+20) or beginning post mile to the nearest hundredth (i.e., 25.06) no leading zero

X = Profile operation as "EXIST" for existing pavement, "INTER" for after prepaving smoothness correction, "PAVE" for after paving, and "CORR" for after final surface pavement correction

PT = Pavement type (i.e., HMA-SP, RHMA-SP-G, HMA-O, RHMA-O, RHMA-G, etc.)

Within 2 business days of performing straightedge measurements, submit areas requiring smoothness correction. Identify locations of smoothness correction by:

1. Location Number
2. District-County-Route
3. Beginning station or post mile to the nearest 0.01 mile
4. For correction areas within a lane:
 - 4.1. Lane direction as NB, SB, EB, or WB
 - 4.2. Lane number from left to right in direction of travel
 - 4.3. Wheel path as "L" for left, "R" for right, or "B" for both
5. For correction areas not within a lane:
 - 5.1. Identify pavement area (i.e., shoulder, weight station, turnout)
 - 5.2. Direction and distance from centerline as "L" for left or "R" for right
6. Estimated size of correction area

39-1.01C(7) Data Cores

At least 3 business days before starting coring, submit proposed methods and materials for backfilling data core holes.

Submit a summary of data cores taken and a photograph of each data core to the Engineer and to:

Coring@dot.ca.gov

39-1.01D Quality Control and Assurance

39-1.01D(1) General

AASHTO T 324 (Modified) is AASHTO T 324, "Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)," with the following parameters:

1. Target air voids must equal 7 ± 1 percent for HMA-SP Type A, and HMA-SP
2. Specimen height must be $60 \text{ mm} \pm 1 \text{ mm}$
3. Number of test specimens must be 4 (2 test sets)
4. Do not average test sets
5. Test specimen must be a 150 mm gyratory compacted specimen
6. Test temperature must be set at:
 - 6.1. 113 ± 2 degrees F for PG 58
 - 6.2. 122 ± 2 degrees F for PG 64
 - 6.3. 131 ± 2 degrees F for PG 70 and above
7. Measurements for impression must be taken at every 100 passes
8. Inflection point defined as the number of wheel passes at the intersection of the creep slope and the stripping slope
9. Testing shut off must be set at 25,000 passes

During production, take samples under California Test 125.

If the Engineer requests, sample the following materials in the presence of the Engineer and place in labeled containers weighing no more than 50 lbs each:

1. Coarse, fine, and supplemental fine aggregate from stockpiles, cold feed belts, or hot bins. Samples must include at least 150 lbs for each coarse aggregate, 100 lbs for each fine aggregate, and 10 lbs for each type of supplemental fines. The Department combines these aggregate samples to comply with the JMF target values submitted on *Contractor Job Mix Formula Proposal* form.
2. RAP from stockpiles or RAP system. Samples must be at least 100 lbs.

3. Asphalt binder from the binder supplier. Samples must be in four 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 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.

39-1.01D(2) Reserved

39-1.01D(3) Quality Control Plan

Implement your QC plan. If a change to your QC plan is needed, do not implement the change without authorization.

39-1.01D(4) Prepaving Conference

Meet with the Engineer at a prepaving conference at a mutually agreed time and place. Discuss the QC plan and the methods of performing production and paving work.

The following personnel must attend the prepaving conference:

1. Project Manager
2. Superintendent
3. HMA plant manager
4. HMA paving foreman
5. Technical representative for WMA technology, if WMA technology is used

39-1.01D(5) Quality Control Testing

Establish, maintain, and change a quality control system to ensure materials and work comply with the specifications. Submit quality control test results within 3 business days of a request.

Perform sampling and testing as specified in the following 4 tables:

Minimum Quality Control Requirements for Aggregate

Quality characteristic	Test method	Minimum sampling and testing frequency	HMA-SP		
			Type A	RHMA-SP-G	OGFC
Aggregate gradation ^a	AASHTO T 27	1 per 750 tons and any remaining part	JMF ± Tolerance ^b	JMF ± Tolerance ^b	JMF ± Tolerance ^b
Sand equivalent (min.) ^c	AASHTO T 176		47	47	--
Aggregate moisture content at continuous mixing plants and RAP moisture content at continuous mixing plants and batch mixing plants	AASHTO T 329	1 per 1500 tons and any remaining part	Report Only	Report Only	Report Only
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	AASHTO T 335	One per 10,000 tons or 2 per project whichever is more	95	--	90
			90	90	90
Los Angeles Rattler (% max.) Loss at 100 rev. Loss at 500 rev.	AASHTO T 96		12 40	12 40	12 40
Flat and elongated particles (% max. by weight @ 5:1) 1/4" thru 3/4" grading 1" grading	ASTM D 4791		Report only 10	Report only	Report only
Fine aggregate angularity (% min.)	AASHTO T 304, Method A		45	45	--

^aIf RAP is used, test the combined aggregate gradation under Laboratory Procedure LP-9.

^bComply with the allowable tolerances in section 39-1.01D(7).

^cReport the average of 3 tests from a single split sample. Use of a Sand Reader Indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 4.8, 7.1.2, 8.4.2 and 8.4.3 do not apply.

Minimum Quality Control Requirements for in Place HMA

Quality Characteristic	Test method	Minimum sampling and testing frequency	HMA-SP		
			Type A	RHMA-SP-G	OGFC
Asphalt binder content (%)	AASHTO T 308 Method A	1 per 750 tons and any remaining part	JMF - 0.3, + 0.5	JMF - 0.4, + 0.5	JMF - 0.4, + 0.5
HMA moisture content (% max.)	AASHTO T 329	1 per 2,500 tons but not less than 1 per paving day	1.0	1.0	1.0
Air voids content (%) ^a 1/4" and 3/8 gradings 1/2" and 3/4" gradings 1" grading with PG64-28M 1" grading with all other binders	AASHTO T 269	One per 4,000 tons or 2 per 5 business days, whichever is more	4 ± 1.5 4 ± 1.5 5 ± 1.5 4 ± 1.5	Specification ± 1.5	--
Voids in mineral aggregate (% min.) 1/4" grading 3/8" grading 1/2" grading 3/4" grading 1" grading with NMA=1" with NMA=3/4"	SP-2 Asphalt Mixtures Volumetrics ^a		16.5-19.5 15.5-18.5 14.5-17.5 12.5-15.5 12.5-15.5 13.5-16.5	-- -- 18.0-23.0 18.0-23.0	--
Dust proportion 1/4" and 3/8" gradings 1/2" and 3/4" gradings 1" grading	SP-2 Asphalt Mixtures Volumetrics ^a		0.6-1.3 0.6-1.3 0.6-1.3	Report only	--

^aDetermine bulk specific gravity using AASHTO T 275.

Minimum Quality Control Requirements for in Place HMA

Quality Characteristic	Test method	Minimum sampling and testing frequency	HMA-SP		
			Type A	RHMA-SP-G	OGFC
Percent of theoretical maximum density (%) by core ^{a, b, c}	California Test 375	2 per paving day (min.)	92-97	92-97	--
Percent of theoretical maximum density by Nuclear gauge (%) ^{a, b, d}	California Test 375	3 per 250 tons but not less than 3 per paving day	92-97	92-97	--
Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) PG 58 PG 64 PG-70 PG-76 or higher	AASHTO T 324 (Modified) ^e	One per 10,000 tons or 1 per project whichever is more	10,000 15,000 20,000 25,000	15,000 20,000 25,000 --	--
Hamburg wheel track (inflection point minimum number of passes) PG 58 PG 64 PG-70 PG-76 or higher	AASHTO T 324 (Modified) ^e		10,000 10,000 12,500 15,000	10,000 12,500 15,000 --	--
Moisture susceptibility (minimum dry strength, psi)	AASHTO T 283 ^f	One per 10,000 tons or 1 per project whichever is more	100	100	--
Moisture susceptibility (minimum wet strength, psi)	AASHTO T 283 ^{f, g}		70	70	--

^aDetermine theoretical maximum density if any of the following applies:

1. 1/2-inch, 3/8-inch, or 1/4-inch grading is used and the specified total paved thickness is at least 0.15 foot.
2. 1- inch and 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

^bDetermine percent of theoretical maximum density under California Test 375 except use:

1. AASHTO T 275 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. AASHTO T 209 Method A to determine theoretical maximum density instead of calculating test maximum density in Part 5, "Determining Test Maximum Density."

^cDetermine theoretical maximum density under AASHTO T 209 Method A at the frequency specified for Test Maximum Density in California Test 375, Part 5.D. Use a digital manometer and a pycnometer when performing AASHTO T 209.

^dVerify gauge correlation to cores every 10,000 tons utilizing the average of two cores.

^eTest as specified in section 39-1.01D(1).

^fTest specimen must be 100 mm or 150 mm gyratory compacted specimens

^gFreeze thaw required.

Miscellaneous Minimum Quality Control Requirements

Quality Characteristic	Test method	Minimum sampling and testing frequency	HMA		
			Type A	RHMA-SP-G	OGFC
Smoothness	LP-13	--	12-foot straightedge, localized roughness, and MRI	12-foot straightedge, localized roughness, and MRI	12-foot straightedge, localized roughness, and MRI
Asphalt rubber binder viscosity @ 375 °F (centipoises)	LP-11	Once per hour, minimum of 1 test per batch	--	1,500 – 4,000	1,500 – 4,000
Asphalt modifier	ASTM D 445 ASTM D 92 ASTM D 2007	1 per truckload delivered to the RHMA-G-SP production facility	--	Section 39-1.02D(2)(b)	Section 39-1.02D(2)(b)
Crumb rubber modifier	LP-10 CT 208 ASTM D 297	1 per truckload delivered to the RHMA-G-SP production facility	--	Section 39-1.02D(2)(e)	Section 39-1.02D(2)(e)

Prepare 3 briquettes for air voids content and VMA determination. Report the average of 3 tests.

For any quality characteristic except smoothness, if 2 consecutive quality control test results for 1 day's production do not comply with the specifications:

1. Notify the Engineer
2. Take corrective action
3. Show how you will comply with the specifications before resuming production and placement on the State highway

For any quality characteristic except smoothness, if any 3 quality control test results for 1 day's production do not comply with the specifications:

1. Stop production
2. Notify the Engineer
3. Take corrective action
4. Show how you will comply with the specifications before resuming production and placement on the State highway

39-1.01D(6) 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. Use an AASHTO-certified laboratory for testing.

Test asphalt rubber binder for compliance with the viscosity requirements in section 39-1.02D(2)(d). 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 lot. Each asphalt binder lot consist of 1 or multiple batches of combined asphalt binder, asphalt modifier, and CRM proportioned under section 39-1.02D(2)(e). Log the measurements with the corresponding time and asphalt rubber binder temperature.

Sample and test gradation and wire and fabric content of CRM once per 10,000 lbs of scrap tire CRM and once per 3,400 lbs of high natural CRM. Sample and test scrap tire CRM and high natural CRM separately.

39-1.01D(7) Aggregate

Laboratories testing aggregate qualities and preparing the mix design and JMF must be qualified under AASHTO Materials Reference Laboratory program (AMRL), and the Department's Independent Assurance Program. Take samples under California Test 125.

Determine the aggregate moisture content in continuous mixing plants at a rate of 1 per 1500 tons and any remaining part.

39-1.01D(8) Reclaimed Asphalt Pavement

Sample and test processed RAP at a minimum frequency of 1 sample per 1000 tons with a minimum of 6 samples per fractionated stockpile to assure that its asphalt binder content and specific gravity meet the processed RAP quality characteristics. If a fractionated RAP stockpile is augmented, sample and test processed RAP quality characteristics at a minimum frequency of 1 sample per 500 tons of augmented RAP.

The quality characteristic for processed RAP asphalt binder content must be within ± 2.0 percent of the average fractionated RAP stockpile asphalt binder content when tested under ASTM D 2172 (Method B). If new fractionated RAP stockpiles are required, the average binder content of the new fractionated RAP stockpile must be within ± 2.0 percent of the average binder content of the original fractionated RAP stockpile.

The quality characteristic for maximum specific gravity for processed RAP must be within ± 0.06 when tested under AASHTO T 209, of the average maximum specific gravity reported on page 4 of your *Contractor Hot Mix Asphalt Design Data* form.

During production, sample RAP twice daily and perform QC testing for:

1. Aggregate gradation at least once a day under Laboratory Procedure LP-9
2. Moisture content at least twice a day

39-1.01D(9) Liquid Antistrip Treatment

For continuous mixing and batch mixing operations, sample asphalt binder before adding LAS. For continuous mixing operations, sample combined asphalt binder and LAS after the static mixer.

39-1.01D(10) Aggregate Lime Treatment

For lime slurry aggregate treatment and dry lime aggregate treatment with marination, sample and test before treatment at the minimum frequencies shown in the following table:

Aggregate Quality Control During Lime Treatment

Quality characteristic	Test method	Minimum sampling and testing frequency
Sand equivalent	AASHTO T 176	Once per 750 tons of untreated aggregate
Percent of crushed particles	AASHTO T 335	One per 10,000 tons or 2 per project whichever is more
Los Angeles Rattler	AASHTO T 96	
Fine aggregate angularity	AASHTO T 304 method A	
Flat and elongated particles	ASTM D4791	

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.

For lime slurry aggregate treatment, determine the aggregate moisture content at least once during each 2 hours of treatment. Calculate moisture content under AASHTO T 329 and report it as a percent of dry aggregate weight. Use the moisture content calculations as a set point for the proportioning process controller.

39-1.01D(11) 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. You must identify your sampling location in your Quality Control Plan.

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.

You and the Engineer must test the split samples and report test results 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.

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 AASHTO T 275, Method A in addition to the percent of theoretical maximum density. You must test for in-place density at the density core locations and include them in your production tests for percent of theoretical maximum density.

39-1.01D(12) Nuclear Gauge Density

During HMA placement determine HMA density using a nuclear gauge. On the 1st day of production, develop a correlation factor between cores and nuclear gauge under California Test 375.

Take a minimum of 3 nuclear gauge density readings for every 250 tons of HMA placed at random locations you select.

39-1.01D(13) Smoothness

39-1.01D(13)(a) General

Section 39-1.01D(13) includes specifications for measuring pavement smoothness with an inertial profiler (IP) and straightedge, analyzing the data with FHWA's engineering software ProVAL, and correcting deficient smoothness.

Test pavement smoothness using an IP except use a 12-foot straightedge at the following locations:

1. Traffic lanes less than 1,000 feet in length including ramps, turn lanes, and acceleration and deceleration lanes
2. HMA pavement within 3 feet from and parallel to the construction joint formed between curbs, gutters, or existing pavement
3. Areas within 15 feet of manholes
4. Shoulders
5. Weigh-in-motion areas
6. Miscellaneous areas such as medians, gore areas, turnouts, and maintenance pullouts

Where IP testing is required, pavement smoothness for each lane must be determined by the international roughness index (IRI) for the left and right wheel paths in an individual lane and then averaging the results. The average of the IRIs from the left and right wheel paths for the same lane is the mean roughness index (MRI) of the lane. The wheel paths are a pair of lines 3 feet from and parallel to the edge of a lane. Left and right wheel paths are based on the direction of travel.

Where IP testing is required, identify areas of localized roughness. Areas of localized roughness must be identified using the ProVAL smoothness assurance analysis by calculating continuous IRI for each wheel path with a 25-foot interval using a 250 mm filter.

Collect profiling data under AASHTO R 56 and analyze data using 250 mm and IRI filters.

39-1.01D(13)(b) Inertial Profiler Calibration and Verification Tests

IP equipment must display a current certification decal with expiration date.

Operate the IP according to the manufacturer's recommendations and AASHTO R57-10 at 1-inch recording intervals.

Notify the Engineer 2 business days before performing IP calibration and verification testing.

Conduct the following IP calibration and verification tests in the Engineer's presence each day before performing inertial profiling:

1. Block test. Verify the height sensor accuracy under AASHTO R57-10, section 5.3.2.3.
2. Bounce test. Verify the combined height sensor and accelerometer accuracy under AASHTO R57-10, section 5.3.2.3.2.
3. DMI test. Calibrate the accuracy of the testing procedure under AASHTO R56-10, section 8.4.
4. Manufacturer's recommended tests.

Conduct cross correlation IP verification test in the Engineer's presence before performing initial profiling. Verify cross correlation IP verification test at least annually. Conduct 5 repeat runs of the IP on an authorized test section. The test section must be on an existing asphalt concrete pavement surface 0.1 mile long. Calculate a cross correlation to determine the repeatability of your device under Section 8.3.1.2 of AASHTO R56-10 using ProVAL profiler certification analysis with a 3 feet maximum offset. The cross correlation must be a minimum of 0.92.

For each 0.1 mile section, your IRI values must be within 10 percent of the Department's IRI values. The Engineer may order you to recalibrate your IP equipment and reprofile. If your results are inaccurate due to operator error, the Engineer may disqualify your IP operator.

39-1.01D(13)(c) Acceptance Criteria

For areas that require pavement smoothness determined using an IP, the pavement surface must:

1. Have no areas of localized roughness with an IRI greater than 120 in/mi
2. Comply with the MRI requirements shown in the following tables for a 0.1 mile section:

HMA^a Pavement Smoothness Acceptance Criteria

HMA thickness	MRI requirement
> 0.20 foot	60 in/mi or less
≤0.20 foot	75 in/mi or less

^a Except OGFC

OGFC Pavement Smoothness Acceptance Criteria

OGFC placement on	MRI requirement
New construction, or HMA overlay	60 in/mi or less
Existing pavement	75 in/mi or less
Milled surface	75 in/mi or less

For areas that require pavement smoothness determined using a 12-foot straightedge, the HMA pavement surface must not vary from the lower edge of the straightedge by more than:

1. 0.01 foot when the straightedge is laid parallel with the centerline
2. 0.02 foot when the straightedge is laid perpendicular to the centerline and extends from edge to edge of a traffic lane
3. 0.02 foot when the straightedge is laid within 24 feet of a pavement conform

Pavement smoothness may be accepted based on your testing in the absence of the Department's testing.

39-1.01D(13)(d) Smoothness Testing

Notify the Engineer of start location by station and start time at least 2 business days before profiling.

Remove foreign objects on the pavement surface before profiling.

Mark the beginning and ending station on the pavement shoulder before profiling. Stationing must be the same when profiling more than one surface.

While collecting the profile data to determine IRI, record the following locations in the raw profile data:

1. Begin and end of all bridge approach slabs
2. Begin and end of all bridges
3. Begin and end of all culverts visible on the roadway surface

Determine the MRI for 0.1-mile fixed sections using the ProVAL ride quality analysis with a 250 mm filter. Profile the left and right wheel paths of each lane. Calculate the MRI of each lane. A partial section less than 0.1 mile that is the result of an interruption to continuous pavement surface must comply with the MRI specifications for a full section. Adjust the MRI for a partial section to reflect a full section based on the proportion of a section paved.

Determine the areas of localized roughness using a continuous IRI for each wheel path with a 25-foot interval using a 250 mm filter. Localized roughness greater than 120 in/mi must be corrected regardless of the IRI values of a 0.1-mile section.

Determine the MRI of the HMA, except OGFC. If the MRI of the final pavement surface is greater than the MRI acceptance requirement in the table titled "HMA Pavement Smoothness Acceptance Criteria" in section 39-1.01D(13)(c), correct to the MRI acceptance requirement in the table.

The final surface of HMA must meet MRI acceptance requirements in the table titled "HMA Pavement Smoothness Acceptance Criteria" in section 39-1.01D(13)(c), before placing HMA-O or RHMA-O.

Determine the MRI of the OGFC. If OGFC MRI is greater than the accepted value in the table titled "OGFC Pavement Smoothness Acceptance Criteria" in section 39-1.01D(13)(c), correct to the MRI acceptance requirement in the table.

39-1.01D(13)(e) Straightedge

Measure areas that require 12-foot straightedge. If the straightedge measurement is greater than the accepted value in section 39-1.01D(13)(c), correct to the acceptance requirement.

39-1.01D(13)(f) Smoothness Correction

If the final surface of the pavement does not comply with section 39-1.01D(13)(c), grind the pavement to within specified tolerances, remove and replace it, or place an overlay of HMA. Do not start corrective work until your method is authorized.

Smoothness correction of the final pavement surface must leave at least 75 percent of the specified HMA thickness. If ordered, core the pavement at the locations determined by the Engineer. Coring, including traffic control, is change order work. Remove and replace deficient pavement areas where the overlay thickness is less than 75 percent of the thickness specified as determined by the Engineer.

If you choose to correct OGFC, the Engineer determines if the corrective method causes raveling. OGFC that is raveling must be removed and replaced.

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

On ground areas not to be overlaid with OGFC, apply fog seal coat under section 37-2.

Where corrections are made within areas requiring testing with IP, reprofile the entire lane length with the IP device.

Where corrections are made within areas requiring testing with a 12-foot straightedge, retest the corrected area with the straightedge.

39-1.01D(13)(g) Prepaving Inertial Profiler

Not Used

39-1.01D(13)(h) Prepaving Grinding

Not Used

39-1.01D(14) Density Cores

Take 4-inch or 6-inch density cores to determine percent of theoretical maximum density. Take a minimum of 2 density cores each paving day from random locations you select. Backfill and compact holes with authorized material.

39-1.01D(15) Data Cores

Data core summary and data core digital photographs are required to document the pavement structural section. 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. After coring, backfill and compact core holes with authorized material.

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

Prepare a summary 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.

39-1.01D(16) Engineer's Acceptance

The Engineer samples materials for testing under California Test 125 and tests under the applicable test method except samples may only be taken from one of the following:

1. Automatic sampling device, with sample taken from truck
2. Mat behind the paver

The Engineer's sampling and testing is independent of your QC sampling and testing, statistically-based, and random.

If you request, the Engineer splits samples and provides you with a part.

The Engineer prepares 3 briquettes for air voids content and VMA determination. The Engineer reports the average of 3 tests.

The Engineer accepts HMA based on:

1. Accepted JMF
2. Authorized QC plan
3. Visual inspection
4. Compliance quality characteristics of the following 4 tables:

HMA Aggregate Acceptance

Quality characteristic	Test method	HMA-SP		
		(Type A)	RHMA-SP-G	OGFC
Aggregate gradation ^{a, b}	AASHTO T 27	JMF ± Tolerance ^c	JMF ± Tolerance ^c	JMF ± Tolerance ^c
Sand equivalent (min.) ^d	AASHTO T 176	47	47	--
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	AASHTO T 335	95 90 70	-- 90 70	90 90 90
Los Angeles Rattler (%, max.) Loss at 100 rev. Loss at 500 rev.	AASHTO T 96	12 40	12 40	12 40
Fine aggregate angularity (%, min.)	AASHTO T 304 Method A	45	45	--
Flat and elongated particles (%, max. by weight @ 5:1) 1/4" and 3/8" gradings 1/2" and 3/4" gradings 1" grading	ASTM D 4791	Report only Report only 10	Report only Report only	Report only

^aThe Engineer determines combined aggregate gradations containing RAP under Laboratory Procedure LP-9.

^b"X" denotes the sieves the Engineer considers for the specified aggregate gradation.

^cThe tolerances must comply with the allowable tolerances in section 39-1.02E.

^dThe Engineer reports the average of 3 tests from a single split sample.

HMA Mix Acceptance

Quality characteristic	Test method	HMA-SP		
		Type A	RHMA-SP-G	OGFC
Asphalt binder content (%)	AASHTO T 308 Method A	JMF -0.3, +0.5	JMF - 0.4, +0.5	JMF - 0.4, +0.5
HMA moisture content (% max.)	AASHTO T 329	1.0	1.0	1.0
Air voids content (%) ^{a, b}	AASHTO T 269	4 ± 1.5	Specification ± 1.5	--
Voids in mineral aggregate, Laboratory produced HMA ^d (% min.)				
1/4" grading	SP-2	16.5-19.5	--	
3/8" grading	Asphalt	15.5-18.5		
1/2" grading	Mixtures	14.5-17.5	18.0-23.0	--
3/4" grading	Volumetrics ^c	13.5-16.5	18.0-23.0	
1" grading				
with NMAS=1"		13.5-16.5		
with NMAS=3/4"		14.5-17.5		
Voids in mineral aggregate, Plant Produced HMA (% min.)				
1/4" grading	SP-2	15.5-18.5	--	
3/8" grading	Asphalt	14.5-17.5		
1/2" grading	Mixtures	13.5-16.5	18.0-23.0	--
3/4" grading	Volumetrics ^c	12.5-15.5	18.0-23.0	
1" grading				
with NMAS=1"		12.5-15.5		
with NMAS=3/4"		13.5-16.5		
Dust proportion				
1/4" and 3/8" gradings	SP-2	0.6-1.3		
1/2" and 3/4" gradings	Asphalt		Report only	--
1" grading	Mixtures	0.6-1.3		
	Volumetrics ^c	0.6-1.3		
Percent of theoretical maximum density (%) by core ^{e, f, g}	California Test 375	92-97	92-97	--

^aThe Engineer reports the average of 3 tests from a single split sample.

^bThe Engineer determines the bulk specific gravity of each lab-compacted briquette under AASHTO T 275, and theoretical maximum specific gravity under AASHTO T 209, Method A.

^cDetermine bulk specific gravity using AASHTO T 275.

^dThe Engineer determines the laboratory prepared HMA value for mix design verification only

^eThe Engineer determines percent of theoretical maximum density if any of the following:

1. 1/2-inch, 3/8-inch, or 1/4-inch grading is used and the specified total paved thickness is at least 0.15 foot.
2. 1 inch, and 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

^fThe Engineer determines percent of theoretical maximum density under California Test 375 except the Engineer uses:

1. AASHTO T 275 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. AASHTO T 209 Method A to determine theoretical maximum density instead of calculating test maximum density in Part 5, "Determining Test Maximum Density."

^gThe Engineer determines theoretical maximum density (AASHTO T 209 Method A) at the frequency specified for Test Maximum Density under California Test 375, Part 5. D.

HMA Acceptance In Place

Quality characteristic	Test method	HMA-SP		
		Type A	RHMA-SP-G	OGFC
Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) PG 58 PG 64 PG-70 PG-76 or higher	AASHTO T 324 (Modified) ^a	10,000 15,000 20,000 25,000	15,000 20,000 25,000 --	--
Hamburg wheel track (inflection point minimum number of passes) PG 58 PG 64 PG-70 PG-76 or higher	AASHTO T 324 (Modified) ^a	10,000 10,000 12,500 15,000	10,000 12,500 15,000 --	--
Moisture susceptibility (minimum dry strength, psi)	AASHTO T 283 ^b	100	100	--
Moisture susceptibility (minimum wet strength, psi)	AASHTO T 283 ^{b,c}	70	70	--

^aTest as specified in section 39-1.01D(1).

^bTest specimens must be 100mm or 150mm gyratory compacted HMA

^cFreeze thaw required.

Miscellaneous Quality HMA Acceptance

Quality characteristic	Test method	HMA-SP		
		Type A	RHMA-SP-G	OGFC
Smoothness	LP-13	12-foot straightedge, localized roughness, and MRI	12-foot straightedge, localized roughness, and MRI	12-foot straightedge, localized roughness, and MRI
Asphalt rubber binder viscosity @ 375 °F (centipoises)	LP-11	--	1,500–4,000	1,500–4,000
Asphalt modifier	ASTM D 445 ASTM D 92 ASTM D 2007	--	Section 39-1.02D(2)(b)	Section 39-1.02D(2)(b)
Crumb rubber modifier	LP-10 CT 208 ASTM D 297	--	Section 39-1.02D(2)(e)	Section 39-1.02D(2)(e)

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 acceptance test results for 1 day's production 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-SP (Type A) and RHMA-SP-G production. The Engineer determines the percent of theoretical maximum density for each density core by determining the density core's density and dividing by the theoretical maximum density.

The Engineer determines the percent of theoretical maximum density from density cores taken from the final layer measured the full depth of the total paved HMA-SP (Type A), and RHMA-SP-G thickness if any of the following applies:

1. If 1/2-inch, 3/8-inch, or 1/4-inch aggregate grading is used and the specified total paved thickness is at least 0.15 foot and any layer is less than 0.15 foot.
2. If 1 inch, or 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot and any layer is less than 0.20 foot.

If the percent of theoretical maximum density does not comply with the specifications, the Engineer may accept the HMA-SP (Type A) and RHMA-SP-G and the Department deducts payment based on the factors shown in the following tables:

Reduced Payment Factors for Percent of Theoretical Maximum Density

HMA-SP (Type A) and RHMA-SP-G Percent of Theoretical maximum density	Reduced Payment Factor	HMA-SP (Type A) and RHMA-G-SP Percent of Theoretical maximum density	Reduced Payment Factor
92.0	0.0000	97.0	0.0000
91.9	0.0125	97.1	0.0125
91.8	0.0250	97.2	0.0250
91.7	0.0375	97.3	0.0375
91.6	0.0500	97.4	0.0500
91.5	0.0625	97.5	0.0625
91.4	0.0750	97.6	0.0750
91.3	0.0875	97.7	0.0875
91.2	0.1000	97.8	0.1000
91.1	0.1125	97.9	0.1125
91.0	0.1250	98.0	0.1250
90.9	0.1375	98.1	0.1375
90.8	0.1500	98.2	0.1500
90.7	0.1625	98.3	0.1625
90.6	0.1750	98.4	0.1750
90.5	0.1875	98.5	0.1875
90.4	0.2000	98.6	0.2000
90.3	0.2125	98.7	0.2125
90.2	0.2250	98.8	0.2250
90.1	0.2375	98.9	0.2375
90.0	0.2500	99.0	0.2500
< 90.0	Remove and Replace	> 99.0	Remove and Replace

39-1.01D(17) 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 business days of receiving a test result if you dispute the test result.

If you or the Engineer dispute each other's test results, submit quality control test results and copies of paperwork including worksheets used to determine the disputed test results. An independent third party (ITP) performs referee testing. Before the ITP participates in a dispute resolution, the ITP must be qualified under AASHTO Materials Reference Laboratory program (AMRL), and 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 QC or acceptance samples are not available, the ITP uses any available material representing the disputed HMA for evaluation.

39-1.02 MATERIALS

39-1.02A General

Use RAP aggregate for HMA-SP (Type A) and as part of the virgin aggregate in a quantity up to a maximum of 25.0 percent of the aggregate blend.

Do not use RAP aggregate for RHMA-SP-G and OGFC

For replace asphalt concrete surfacing use HMA-SP (Type A)

For the safety edge, use the same type of HMA used for the adjacent lane or shoulder.

For water injection WMA technology, the foaming bitumen must have the following quality characteristics:

Quality Requirements for Foaming Bitumen		
Quality characteristic	Test method	Requirement
Expansion ratio (minimum)	LP-12	4
Half-life (seconds minimum)	LP-12	4

If OGFC is specified, treat aggregate for OGFC with the same antistrip treatment used for HMA .

For miscellaneous areas and dikes:

1. Choose the 3/8-inch or 1/2-inch HMA-SP (Type A) and aggregate gradations.
2. 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 and the Engineer authorizes, you may reduce the minimum asphalt binder content.
3. Choose asphalt binder Grade PG 70-10 or use the same grade specified for HMA-SP.

39-1.02B Geosynthetic Pavement Interlayer

Geosynthetic pavement interlayer must comply with the specifications for paving fabric, paving mat, paving grid, paving geocomposite grid, or geocomposite strip membrane as shown.

39-1.02C Tack Coat

Tack coat must comply with the specifications for asphaltic emulsion or asphalt binder. 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 under section 9-1.02 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:

1. Weight ratio of water to bituminous material in the original asphaltic emulsion
2. Weight of asphaltic emulsion before diluting
3. Weight of added water
4. Final dilution weight ratio of water to asphaltic emulsion

39-1.02D Asphalt Binder

39-1.02D(1) General

Asphalt binder in HMA must comply with section 92.

For HMA-SP (Type A), the grade of binder must be PG 64-10

Asphalt binder for geosynthetic pavement interlayer must comply with section 92. Choose from Grades PG 64-10, PG 64-16, or PG 70-10.

LAS-treated asphalt binder must comply with the specifications for asphalt binder. Do not use LAS as a substitute for asphalt binder.

39-1.02D(2) Asphalt Rubber Binder

39-1.02D(2)(a) General

Use asphalt rubber binder in RHMA-SP-G, and RHMA-O. Asphalt rubber binder must be a combination of:

1. Asphalt binder
2. Asphalt modifier
3. CRM

The combined asphalt binder and asphalt modifier must be 80.0 ± 2.0 percent by weight of the asphalt rubber binder.

Determine the amount of asphalt rubber binder to be mixed with the aggregate for RHMA-SP-G as follows:

1. Base the calculations on the average of 3 briquettes produced at each asphalt rubber binder content.
2. Plot asphalt rubber binder content versus average air voids content for each set of three specimens and connect adjacent points with a best-fit curve.
3. Calculate voids in mineral aggregate (VMA) for each specimen, average each set, and plot the average versus asphalt rubber binder content.
4. Calculate the dust proportion and plot versus asphalt rubber binder content.
5. From the curve plotted in Step 2, select the theoretical asphalt rubber binder content at:
 - 5.1. 4 percent air voids for PG 64-16 or less.
 - 5.2. 5 percent air voids for PG 70-10 or greater.
6. At the selected asphalt rubber binder content, evaluate corresponding dust proportion to verify compliance with requirements. If necessary, develop an alternate composite aggregate gradation to conform to the RHMA-SP-G requirements.
7. Record the asphalt rubber binder content in Step 5 as the Optimum Bitumen Content (OBC).
8. To establish a recommended range, use the OBC as the high value and 0.2 percent less as the low value. The recommended range must not extend below 7.5 percent by total weight of the mix. If the OBC is 7.5 percent, then there is no recommended range, and 7.5 percent is the recommended value.

Laboratory mixing and compaction must comply with AASHTO R 35, except the mixing temperature of the aggregate must be between 300 degrees F and 325 degrees F. The mixing temperature of the asphalt-rubber binder must be between 375 degrees F and 425 degrees F. The compaction temperature of the combined mixture must be between 290 degrees F and 320 degrees F.

39-1.02D(2)(b) 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	Test method	Requirement
Viscosity, m^2/s ($\times 10^{-6}$) at 100 °C	ASTM D 445	$X \pm 3^a$
Flash Point, CL.O.C., °C	ASTM D 92	207 minimum
Molecular Analysis		
Asphaltenes, percent by mass	ASTM D 2007	0.1 maximum
Aromatics, percent by mass	ASTM D 2007	55 minimum

^aThe 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 rubber modifier must be from 2.0 percent to 6.0 percent by weight of the asphalt binder in the asphalt rubber binder.

39-1.02D(2)(c) Asphalt Rubber Binder Design and Profile

Submit a proposal for asphalt rubber binder design and profile. In the design, include 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 tests shown in the following table:

Asphalt Rubber Binder Reaction Design Profile

Test	Minutes of reaction ^a							Limits
	45	60	90	120	240	360	1440	
Cone penetration @ 77 °F, 0.10-mm (ASTM D 217)	X ^b				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

^a Six hours (360 minutes) after CRM addition, reduce the oven temperature to 275 °F for 16 hours. After the 16-hour (1,320-minutes) cool down after CRM addition, reheat the binder to the reaction temperature expected during production for sampling and testing at 24 hours (1,440 minutes).

^b "X" denotes required testing

39-1.02D(2)(d) Asphalt Rubber Binder

After interacting for at least 45 minutes, asphalt rubber binder must have the values for the quality characteristics shown in the following table:

Asphalt Rubber Binder

Quality characteristic	Test for quality control or acceptance	Test method	Value	
			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

39-1.02D(2)(e) Crumb Rubber Modifier

CRM must consist of a ground or granulated combination of scrap tire CRM and high natural CRM. CRM must be 75.0 ± 2.0 percent scrap tire CRM and 25.0 ± 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	Requirement
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.) ^a	--	3/16
CRM specific gravity ^a	California Test 208	1.1 – 1.2
Natural rubber content in high natural CRM (%) ^a	ASTM D 297	40.0 – 48.0

^aTest 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.

39-1.02E Aggregate

Aggregate must be clean and free from deleterious substances.

Gradations are based on nominal maximum aggregate size (NMAS).

The aggregate for HMA-SP (Type A) must comply with the 3/4-inch grading.

Aggregate gradation must be within the TV limits for the specified sieve size shown in the following tables:

**Aggregate Gradation
(Percentage Passing)
HMA-SP (Type A)**

1 inch HMA-SP (Type A)

Sieve Sizes	Target Value Limits	Allowable Tolerance
1"	100	—
3/4"	88-93	TV ± 5
1/2"	72-85	TV ± 6
3/8"	55-70	TV ± 6
No. 4	35-52	TV ± 7
No. 8	22-40	TV ± 5
No. 30	8-24	TV ± 4
No. 200	3-7	TV ± 2

3/4-inch HMA-SP (Type A)

Sieve Sizes	Target Value Limits	Allowable Tolerance
1"	100	—
3/4"	90–98	TV ± 5
1/2"	70–90	TV ± 6
No. 4	42–58	TV ± 5
No. 8	29–43	TV ± 5
No. 30	10–23	TV ± 4
No. 200	2–7	TV ± 2

1/2-inch HMA-SP (Type A)

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/4"	100	--
1/2"	95–98	TV ± 5
3/8"	72–95	TV ± 5
No. 4	52–69	TV ± 5
No. 8	35–55	TV ± 5
No. 30	15–30	TV ± 4
No. 200	2–8	TV ± 2

3/8-inch HMA-SP (Type A)

Sieve Sizes	Target Value Limits	Allowable Tolerance
1/2"	100	--
3/8"	95–98	TV ± 5
No. 4	55–75	TV ± 5
No. 8	30–50	TV ± 5
No. 30	15–35	TV ± 5
No. 200	2–9	TV ± 2

1/4-inch HMA-SP (Type A)

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/8"	100	--
No. 4	95–98	TV ± 5
No. 8	70–80	TV ± 6
No. 30	34–45	TV ± 5
No. 200	2–12	TV ± 4

**Aggregate Gradation
(Percentage Passing)
Rubberized Hot Mix Asphalt - Gap Graded (RHMA-SP-G)**

3/4-inch RHMA-SP-G

Sieve Sizes	Target Value Limits	Allowable Tolerance
1"	100	--
3/4"	95–98	TV ± 5
1/2"	83–87	TV ± 6
3/8"	65–70	TV ± 5
No. 4	28–42	TV ± 6
No. 8	14–22	TV ± 5
No. 200	0–6	TV ± 2

1/2-inch RHMA-SP-G		
Sieve Sizes	Target Value Limits	Allowable Tolerance
3/4"	100	--
1/2"	90-98	TV ± 6
3/8"	83-87	TV ± 5
No. 4	28-42	TV ± 6
No. 8	14-22	TV ± 5
No. 200	0-6	TV ± 2

**Aggregate Gradation
(Percentage Passing)
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

Aggregate gradation must be before the addition of asphalt binder and must include supplemental fines. The Engineer tests for aggregate grading under AASHTO T 27, note 4, and AASHTO T 11 do not apply. Use a mechanical sieve shaker. Aggregate shaking time must not exceed 10 minutes for both course and fine aggregate portions.

Choose a sieve size TV within each target value limits shown in the tables titled "Aggregate Gradation."

Before the addition of asphalt binder and lime treatment, aggregate must comply with:

Aggregate Quality

Quality characteristic	Test method	HMA-SP		
		Type A	RHMA-G-SP	OGFC
Percent of crushed particles Coarse aggregate (% min.) One fractured face	AASHTO T 335	95	--	90
Two fractured faces		90	90	90
Fine aggregate (% min) (Passing No. 4 sieve and retained on No. 8 sieve.) One fractured face		70	70	90
Los Angeles Rattler (% max.) Loss at 100 Rev.	AASHTO T 96	12	12	12
Loss at 500 Rev.		40	40	40
Sand equivalent (min.) ^{a, b}	AASHTO T 176	47	47	--
Fine aggregate angularity (% min.)	AASHTO T 304 Method A	45	45	--
Flat and elongated particles (% max. by weight @ 5:1)	ASTM D 4791	10	10	10

^aReported value must be the average of 3 tests from a single sample.

^bUse of a Sand Reader Indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 4.8, 7.1.2, 8.4.2 and 8.4.3 do not apply

39-1.02F Reclaimed Asphalt Pavement

For HMA-SP (Type A), substitute RAP aggregate for part of the virgin aggregate in a quantity up to a maximum of 25.0 percent of the aggregate blend

Provide enough space for meeting all RAP handling requirements at your facility. Provide a clean, graded base, well drained area for stockpiles.

If RAP is from multiple sources blend the RAP thoroughly and completely before fractionating.

Fractionate RAP stockpiles into 2 sizes, a coarse fraction RAP retained on 3/8-inch screen, and a fine fraction RAP passing 3/8-inch screen.

RAP Stockpile Fractionation Gradation Requirements

Quality Characteristic	Test Method	Requirement
Course	California Test 202 ^a	100% passing the 1 inch screen
Fine	California Test 202 ^a	98%-100% passing the 3/8 inch screen

^a Maximum mechanical shaking time is 10 minutes

Isolate the processed RAP stockpiles from other materials. Store processed RAP in conical or longitudinal stockpiles. Processed RAP must not be agglomerated or be allowed to congeal in large stockpiles.

39-1.02G Liquid Antistrip

LAS total amine value must be 325 minimum when tested under ASTM D 2074.

Use only 1 LAS type or brand at a time. Do not mix LAS types or brands.

Store and mix LAS under the manufacturer's instruction.

39-1.02H Lime

Lime for treating aggregate must be high-calcium hydrated lime and comply with section 24-2.02B.

39-1.02I Water

Water for lime treated aggregate must comply with section 24-2.02C.

39-1.02J Hot Mix Asphalt Production**39-1.02J(1) General**

Produce HMA in a batch mixing plant or a continuous mixing plant.

HMA plants must be Department-qualified. Before production, the HMA plant must have a current qualification under the Department's Materials Plant Quality Program.

Weighing and metering devices used for the production of additive enhanced HMA must comply with the requirements of the MPQP. If a loss-in-weight meter is used for dry HMA additive, the meter must have an automatic and integral material delivery control system for the refill cycle. Proportion aggregate by hot or cold feed control. During production, you may adjust hot or cold feed proportion controls for virgin aggregate and RAP.

For HMA produced using WMA technology production of HMA must be at a temperature between 240 and 325 degrees F.

For the Method compaction, HMA produced using WMA technology must be produced at the temperatures specified in section 39-1.03E(4).

HMA-SP (Type A) must not exceed 25 percent RAP by weight of the virgin aggregate. Do not use RAP with RHMA-SP-G, RHMA-O, or OGFC.

39-1.02J(2) Mixing

Mix HMA ingredients into a homogeneous mixture of coated aggregates.

Asphalt binder must be from 275 to 375 degrees F when mixed with aggregate.

Asphalt rubber binder must be from 375 to 425 degrees F when mixed with aggregate.

When mixed with asphalt binder, aggregate must not be more than 325 degrees F except aggregate for OGFC with unmodified asphalt binder must be not more than 275 degrees F. Aggregate temperature specifications do not apply to RAP.

HMA must not be more than 325 degrees F.

39-1.02J(3) Asphalt Rubber Binder

Asphalt rubber binder blending plants must be authorized under the Departments Materials Plant Quality Program

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, mix them for at least 20 minutes. When you add CRM, the asphalt binder and asphalt modifier must be from 375 to 440 degrees 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 degrees F and the lower of 425 or 25 degrees 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 degrees 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 39-1.02D(2). Do not reheat asphalt rubber binder more than twice.

39-1.02J(4) Proportioning Warm Mix Asphalt Technologies

Proportion all ingredients by weight. The HMA plant process controller (PPC) must be the sole source of ingredient proportioning control and be fully interfaced with all scales and meters used in the production process. The addition of the HMA additive must be controlled by the PPC.

Calibrate the loss-in-weight meter by:

1. Including at least 1 complete system refill cycle during each calibration test run
2. Operating the device in a normal run mode for 10 minutes immediately before starting the calibration process
3. Isolating the scale system within the loss-in-weight feeder from surrounding vibration
4. Checking the scale system within the loss-in-weight feeder for accuracy before and after the calibration process and daily during mix production
5. Using a 15-minute or 250-pound-minimum test run size for a dry ingredient delivery rate of less than 1 ton/hr
6. Complying with the limits of Table B, "Conveyor Scale Testing Extremes," in the MPQP

Produce additive enhanced HMA by using either a continuous mixing or a batch type HMA plant.

Liquid ingredient additive, including a normally dry ingredient made liquid, must be proportioned with a mass flow meter at continuous mixing plants. Use a mass flow meter or a container scale to proportion liquid additives at batch mixing plants.

Continuous mixing plants using HMA additives must comply with the following:

1. Dry ingredient additives for continuous production must be proportioned with a conveyor scale or a loss-in-weight meter.
2. HMA PPC and ingredient measuring systems must be capable of varying all ingredient feed rates proportionate with the dry aggregate delivery at all production rates and rate changes.
3. Liquid HMA additive must enter the production stream with the binder. Dry HMA additive must enter the production stream at or before the mixing area.
4. If dry HMA additives are used at continuous mixing HMA plants, baghouse dust systems must return all captured material to the mix.
5. HMA additive must be proportioned to within ± 0.3 percent of the target additive rate.

Batch mixing plants using HMA additives must comply with the following:

1. Metered HMA additive must be placed in an intermediate holding vessel before being added to the stream of asphalt binder as it enters the pugmill.
2. If a container scale is used, weigh additive before combining with asphalt binder. Keep the container scale separate from other ingredient proportioning. The container scale capacity must be no more than twice the volume of the maximum additive batch size. The container scale's graduations must be smaller than the proportioning tolerance or 0.001 times the container scale capacity.
3. Dry HMA additive proportioning devices must be separate from metering devices for the aggregates and asphalt binder. Proportion dry HMA additive directly into the pugmill or place in an intermediate holding vessel to be added to the pugmill at the appropriate time in the batch cycle. Dry ingredients for batch production must be proportioned with a hopper scale.
4. Zero tolerance for the HMA additive batch scale is ± 0.5 percent of the target additive weight. The indicated HMA additive batch scale weight may vary from the preselected weight setting by up to ± 1.0 percent of the target additive weight.

The HMA plant must have a sampling device in the feed line connecting the additive storage to the additive metering system. The sampling equipment must comply with California Test 125.

39-1.02J(5) Liquid Antistrip Treatment

Perform liquid antistrip treatment (LAS) when the HMA mix design determines LAS treatment of HMA is required. LAS must be from 0.5 to 1.0 percent by weight of asphalt binder.

If 3 consecutive sets of recorded production data show actual delivered LAS weight is more than ± 1 percent of the authorized mix design LAS weight, stop production and take corrective action.

If a set of recorded production data shows actual delivered LAS weight is more than ± 2 percent of the authorized mix design LAS weight, stop production. If the LAS weight exceeds 1.2 percent of the asphalt binder weight, do not use the HMA represented by that data.

The continuous mixing plant controller proportioning the HMA must produce a production data log. The log consists of a series of data sets captured at 10-minute intervals throughout daily production. The data must be a production activity register and not a summation. The material represented by the data is the quantity produced 5 minutes before and 5 minutes after the capture time. For the duration of the Contract, collected data must be stored by the plant controller or a computer's memory at the plant.

The Engineer orders proportioning operations stopped for any of the following if you:

1. Do not submit data
2. Submit incomplete, untimely, or incorrectly formatted data
3. Do not take corrective actions
4. Take late or unsuccessful corrective actions
5. Do not stop production when proportioning tolerances are exceeded
6. Use malfunctioning or failed proportioning devices

If you stop production, notify the Engineer of any corrective actions taken before resuming.

39-1.02J(6) Aggregate Lime Treatment

Perform aggregate lime treatment when the HMA mix design determines aggregate lime treatment is required. Notify the Engineer at least 24 hours before the start of aggregate treatment.

Do not treat RAP.

For aggregate dry lime treatment, marinate aggregate if the plasticity index determined under California Test 204 is from 4 to 10.

For lime slurry aggregate treatment, treat aggregate separate from HMA production, stockpile and marinate the aggregate.

If marination is required:

1. Treat and marinate coarse and fine aggregates separately.
2. Treat the aggregate and stockpile for marination only once.
3. Treat the aggregate separate from HMA production.

The lime ratio is the pounds of dry hydrated lime per 100 lbs. of dry virgin aggregate expressed as a percentage. Water content of slurry or untreated aggregate must not affect the lime ratio.

Aggregate gradations must have the lime ratio ranges shown in the following table:

Aggregate gradation	Lime ratio percent
Coarse	0.4–1.0
Fine	1.5–2.0
Combined	0.8–1.5

You may reduce the combined aggregate lime ratio for OGFC to 0.5 from 1.0 percent.

The lime ratio for fine and coarse aggregate must be within ± 0.2 percent of the lime ratio in the accepted JMF. The lime ratio must be within ± 0.2 percent of the authorized lime ratio when you combine the individual aggregate sizes in the JMF proportions. The lime ratio must be determined before the addition of RAP.

The device controlling lime and aggregate 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 a data set is the quantity produced 5 minutes before and 5 minutes after the capture time. For the duration of the Contract, collected data must be stored by the controller.

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 treated aggregate 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.

39-1.02J(7) Proportioning Dry Lime

Proportion dry lime by weight with a continuous operation.

If you use a batch-type proportioning operation for HMA production, control proportioning in compliance with the specifications for continuous mixing plants. Use a separate dry lime aggregate treatment operation from HMA batching operations including:

1. Pugmill mixer
2. Controller
3. Weigh belt for the lime
4. Weigh belt for the aggregate

If using a continuous mixing operation for HMA without lime marinated aggregates, use a controller that measures the blended aggregate weight after any additional water is added to the mixture. The controller must determine the quantity of lime added to the aggregate from the aggregate weigh belt input in connection with the manually input total aggregate moisture, the manually input target lime content, and the lime proportioning system output. Use a continuous aggregate weigh belt and pugmill mixer for the lime treatment operation in addition to the weigh belt for the aggregate proportioning to asphalt binder in the HMA plant. If you use a water meter for moisture control for lime treatment, the meter must comply with Materials Plant Quality Program manual.

At the time of mixing dry lime with aggregate, the aggregate moisture content must ensure complete lime coating. The aggregate moisture content must not cause aggregate to be lost between the point of weighing the combined aggregate continuous stream and the dryer. Add water for mixing and coating aggregate to the aggregate before dry lime addition. Immediately before mixing lime with aggregate, water must not visibly separate from aggregate.

The HMA plant must be equipped with a bag-house dust system. Material collected in the dust system must be returned to the mix.

39-1.02J(8) Proportioning Lime Slurry

Proportion lime and water with a continuous or batch operation.

Add lime to the aggregate as slurry consisting of mixed dry lime and water at a ratio of 1 part lime to from 2 to 3 parts water by weight. The slurry must completely coat the aggregate.

Immediately before mixing lime slurry with the aggregate, water must not visibly separate from the aggregate.

39-1.02J(9) Mixing Dry Lime and Aggregate

Mix aggregate, water, and dry lime with a continuous pugmill mixer with twin shafts. Immediately before mixing lime with aggregate, water must not visibly separate from the aggregate. Store dry lime in a uniform and free-flowing condition. Introduce dry lime to the pugmill in a continuous operation. The introduction must occur after the aggregate cold feed and before the point of proportioning across a weigh belt and the aggregate dryer. Prevent loss of dry lime.

The pugmill must be equipped with paddles arranged to provide sufficient mixing action and mixture movement. The pugmill must produce a homogeneous mixture of uniformly coated aggregates at mixer discharge.

If the aggregate treatment operation is stopped longer than 1 hour, clean the equipment of partially treated aggregate and lime.

Aggregate must be completely treated before introduction into the mixing drum.

39-1.02J(10) Mixing Lime Slurry and Aggregate

Proportion lime slurry and aggregate by weight in a continuous operation.

39-1.02J(11) Production

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 Department does not test treated aggregate for acceptance except for gradation.

The Engineer determines the combined aggregate gradation during HMA production after you have treated the aggregate.

Treated aggregate must not have lime balls or clods.

For any of the following, the Engineer orders proportioning operations stopped if you:

1. Do not submit the treatment data log
2. Do not submit the aggregate quality control data for marinated aggregate
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.

If marination is required, marinate treated aggregate in stockpiles from 24 hours to 60 days before using in HMA. Do not use aggregate marinated longer than 60 days.

39-1.02J(12) Spreading and Compacting Equipment

39-1.02J(12)(a) General

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.

39-1.02J(12)(b) Method Compaction Equipment

For method compaction, each paver spreading HMA 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-SP under the specifications for compacting HMA 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 to 172 lbs per linear inch of drum width. Turn the vibrator off.

39-1.02J(12)(c) Material Transfer Vehicle

A material transfer vehicle (MTV) must be used when placing RHMA-SP-G, HMA-O, or RHMA-O.

The MTV must:

1. Either receive HMA directly from trucks or use a windrow pickup head to load it from a windrow deposited on the roadway surface.
2. Transfer HMA directly into the paver's receiving hopper or feed system.
3. Remix the HMA, with augurs, before loading the paver.
4. Have sufficient capacity to prevent stopping the paver.

39-1.03 CONSTRUCTION

39-1.03A General

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, pickup, loading, and paving are continuous
4. HMA temperature in the windrow does not fall below 260 degrees F

You may place 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 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

39-1.03B Miscellaneous Areas and Dikes

For miscellaneous areas and dikes, prepare the area to receive HMA. Preparing the area includes excavating and backfilling as needed. Spread HMA in 1 layer and compact to the specified lines and grades.

The finished surface must be:

1. Textured uniformly
2. Compacted firmly
3. Without depressions, humps, and irregularities
4. In compliance with the straightedge specifications for smoothness

39-1.03C Replace Asphalt Concrete Surfacing

Remove existing asphalt concrete surfacing and underlying base and replace with HMA. The Engineer determines the exact limits of replaced asphalt concrete surfacing.

Place replacement HMA under section 39-1.03E.

Replace asphalt concrete in a lane before the lane is specified to be opened to traffic under section 12-4.

Before removing asphalt concrete, outline the replacement area and cut neat lines with a saw or grind to full depth of the existing asphalt concrete. Do not damage asphalt concrete and base remaining in place.

Dispose of removed material.

If the base is excavated beyond the specified plane, replace it with HMA. The Department does not pay for this HMA

39-1.03D Surface Preparation

39-1.03D(1) General

Prepare subgrade or apply tack coat to surfaces receiving HMA. If specified, place geosynthetic pavement interlayer over a coat of asphalt binder.

39-1.03D(2) Subgrade

Subgrade to receive HMA-SP (Type A) 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-SP (Type A) is paved on existing base or pavement, remove loose paving particles, dirt, and other extraneous material by any means including flushing and sweeping.

39-1.03D(3) 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

HMA over:	Minimum Residual Rates (gal/sq yd)		
	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
Existing AC and PCC pavement	0.03	0.04	0.03
Planned pavement	0.05	0.06	0.04

Tack Coat Application Rates for OGFC

OGFC over:	Minimum Residual Rates (gal/sq yd)		
	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
Existing AC and PCC pavement	0.05	0.06	0.04
Planned pavement	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 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. Surface is at least 140 degrees 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 temperature must be from 285 to 350 degrees F when applied.

39-1.03D(4) Geosynthetic Pavement Interlayer

If the Contract includes a bid item for 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. Repairing cracks is change order 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.

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.

39-1.03E Transporting, Spreading, and Compacting

39-1.03E(1) General

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 degrees F

HMA deposited in a windrow on the roadway surface must not extend more than 100 feet in front of the loading equipment or MTV.

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, hand tools 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 other longitudinal joint placement patterns.

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.

39-1.03E(2) Leveling

If a leveling course using HMA-SP (Type A) is specified, fill and level irregularities and ruts with HMA-SP (Type A) 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 paid for as 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.

39-1.03E(3) Compaction

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 degrees F for HMA-SP (Type A) with unmodified binder
2. Below 140 degrees F for HMA-SP (Type A) with modified binder
3. Below 200 degrees F for RHMA-SP-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-SP-G.

If a 3/4-inch aggregate grading is specified, you may use a 1/2-inch aggregate grading if the specified paved thickness is from 0.15 to 0.20 foot thick.

Spread and compact HMA as specified for method compaction in section 39-1.03E(4) for any of the following conditions:

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. Specified paved thickness is less than 0.25 foot and a 1-inch aggregate grading is specified and used.
4. You spread and compact at:
 - 4.1. Asphalt concrete surfacing replacement areas
 - 4.2. Leveling courses
 - 4.3. Areas the Engineer determines conventional compaction and compaction measurement methods are impeded

Do not open new HMA pavement to traffic until its mid-depth temperature is below 160 degrees F.

If you request and the Engineer authorizes, you may cool HMA-SP (Type A) with water when rolling activities are complete. Apply water under section 17.

Spread sand at a rate between 1 pound and 2 pounds per square yard on new RHMA-SP-G, and RHMA-O pavement when finish rolling is complete. Sand must be free of clay or organic matter. Sand must comply with section 90-1.02C(3). Keep traffic off the pavement until spreading sand is complete.

39-1.03E(4) Method Compaction

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-SP (Type A) only if atmospheric and surface temperatures are:

Minimum Atmospheric and Surface Temperatures

Compacted Layer Thickness, feet	Atmospheric, °F		Surface, °F	
	Unmodified Asphalt Binder	Modified Asphalt Binder ^a	Unmodified Asphalt Binder	Modified Asphalt Binder ^a
< 0.15	55	50	60	55
0.15 – 0.25	45	45	50	50

^aExcept asphalt rubber binder.

If the asphalt binder for HMA-SP (Type A) is:

1. Unmodified asphalt binder, complete:
 - 1.1. First coverage of breakdown compaction before the surface temperature drops below 250 degrees F
 - 1.2. Breakdown and intermediate compaction before the surface temperature drops below 190 degrees F
 - 1.3. Finish compaction before the surface temperature drops below 150 degrees F
2. Modified asphalt binder, complete:
 - 2.1. First coverage of breakdown compaction before the surface temperature drops below 240 degrees F
 - 2.2. Breakdown and intermediate compaction before the surface temperature drops below 180 degrees F
 - 2.3. Finish compaction before the surface temperature drops below 140 degrees F

For RHMA-SP-G:

1. Only spread and compact if the atmospheric temperature is at least 55 degrees F and the surface temperature is at least 60 degrees F.
2. Complete the first coverage of breakdown compaction before the surface temperature drops below 285 degrees F.
3. Complete breakdown and intermediate compaction before the surface temperature drops below 250 degrees F.
4. Complete finish compaction before the surface temperature drops below 200 degrees F.
5. If the atmospheric temperature is below 70 degrees 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 HMA-O with unmodified asphalt binder:

1. Only spread and compact if the atmospheric temperature is at least 55 degrees F and the surface temperature is at least 60 degrees F.
2. Complete first coverage using 2 rollers before the surface temperature drops below 240 degrees F.
3. Complete all compaction before the surface temperature drops below 200 degrees F.
4. If the atmospheric temperature is below 70 degrees 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 HMA-O with modified asphalt binder except asphalt rubber binder:

1. Only spread and compact if the atmospheric temperature is at least 50 degrees F and the surface temperature is at least 50 degrees F.
2. Complete first coverage using 2 rollers before the surface temperature drops below 240 degrees F.
3. Complete all compaction before the surface temperature drops below 180 degrees F.
4. If the atmospheric temperature is below 70 degrees 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:

1. Only spread and compact if the atmospheric temperature is at least 55 degrees F and surface temperature is at least 60 degrees F.
2. Complete the 1st coverage using 2 rollers before the surface temperature drops below 280 degrees F.
3. Complete compaction before the surface temperature drops below 250 degrees F.
4. If the atmospheric temperature is below 70 degrees 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-SP-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-SP (Type A), and RHMA-SP-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-SP (Type A) or RHMA-SP-G layer thickness is less than 0.08 foot, turn the vibrator off.

The Engineer may order fewer coverages if the HMA-SP (Type A), or RHMA-SP-G layer thickness is less than 0.15 foot.

The Engineer may order fewer coverages if the layer thickness is less than 0.20 foot.

Perform intermediate compaction of each layer of HMA-SP (Type A) and RHMA-SP-G with 3 coverages using a pneumatic-tired roller at a speed not to exceed 5 mph.

Perform finish compaction of HMA-SP (Type A) and RHMA-SP-G with 1 coverage using a steel-tired roller.

Compact OGFC with 2 coverages using steel-tired rollers.

39-1.03F Rumble Strips

Not Used

39-1.03G Vertical Joints

Do not leave a vertical joint more than 0.15 foot high between adjacent lanes open to traffic.

Before opening the lane to public traffic, pave shoulders and median borders adjacent to a lane being paved.

39-1.03H Tapered Notched Wedge

For divided highways with an HMA lift thickness greater than 0.15 foot, you may construct a 1-foot wide tapered notched wedge joint as a longitudinal joint between adjacent lanes open to traffic. A vertical notch of 0.75 inch maximum must be placed at the top and bottom of the tapered wedge.

The tapered notched wedge must retain its shape while exposed to traffic. Pave the adjacent lane within 1 day.

Construct the tapered portion of the tapered notched wedge with an authorized strike-off device. The strike-off device must provide a uniform slope and must not restrict the main screed of the paver.

You may use a device attached to the screed to construct longitudinal joints that will form a tapered notched wedge in a single pass. The tapered notched wedge must be compacted to a minimum of 91 percent compaction.

Perform QC testing on the completed tapered notch wedge joint as follows:

1. Perform field compaction tests at the rate of 1 test for each 750-foot section along the joint. Select random locations for testing within each 750-foot section.
2. Perform field compaction tests at the centerline of the joint, 6 inches from the upper vertical notch, after the adjacent lane is placed and before opening the pavement to traffic.
3. Determine maximum density test results.
4. Determine percent compaction of the longitudinal joint as the ratio of the average of the field compaction values and the maximum density test results.

For acceptance of the completed tapered notch wedge joint, take two 4- or 6-inch diameter cores 6 inches from the upper vertical notch of the completed longitudinal joint for every 3,000 feet at locations designated by the Engineer. Take cores after the adjacent lane is placed and before opening the pavement to traffic. Cores must be taken in the presence of the Engineer and must be marked to identify the test sites. Submit the cores. One core will be used for determination of the field density and 1 core will be used for dispute resolution. The Engineer determines:

1. Field compaction by measuring the bulk specific gravity of the cores under AASHTO T 275, Method A
2. Percent compaction as the ratio of the average of the bulk specific gravity of the core for each day's production to the maximum density test value

in the Engineer's verification testing and in the computation of any quality factor and process control.

Determine percent compaction values each day the joint is completed and submit values within 24 hours of testing. If the percent compaction of 1 day's production is less than 91 percent, that day's notched wedge joint is rejected. Discontinue placement of the tapered notched wedge and notify the Engineer of changes you will make to your construction process in order to meet the specifications.

39-1.03I Shoulders, Medians, and Other Road Connections

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 changes, 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.

39-1.03J Widening

Not Used

39-1.03K Edge Treatment

The edge of roadway where the safety edge treatment is to be placed must have a solid base, free of debris such as loose material, grass, weeds, or mud. Grade areas to receive the safety edge as required.

The safety edge treatment must be placed monolithic with the adjacent lane or shoulder and shaped and compacted with a device attached to the paver.

The device must be capable of shaping and compacting HMA to the required cross section as shown. Compaction must be by constraining the HMA to reduce the cross sectional area by 10 to 15 percent. The device must produce a uniform surface texture without tearing, shoving, or gouging and must not leave marks such as ridges and indentations. The device must be capable of transition to cross roads, driveways, and obstructions.

For safety edge treatment, the angle of the slope must not deviate by more than ± 5 degrees from the angle shown. Measure the angle from the plane of the adjacent finished pavement surface.

If paving is done in multiple lifts, the safety edge treatment must be placed with each lift.

Short sections of hand work are allowed to construct transitions for safety edge treatment.

39-1.03L Conform Tapers

Not Used

39-1.04 PAYMENT

The weight of each HMA mixture shown in the Bid Item List is the combined mixture weight.

If tack coat, asphalt binder, and asphaltic emulsion are paid as separate bid items, their bid items are measured under section 92 or section 94.

If recorded batch weights are printed automatically, the bid 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. Copy of the recorded batch weights is certified by a licensed weigh master and submitted.

Place hot mix asphalt dike of the type specified is measured along the completed length.

Place hot mix asphalt (miscellaneous areas) is measured as the in-place compacted area.

If replace asphalt concrete surfacing is shown the bid item for replace asphalt concrete is measured based on the specified dimensions and any adjustments ordered.

HMA dike is paid for as place hot mix asphalt dike of the type specified in the Bid Item List and by weight for hot mix asphalt.

HMA specified to be placed in miscellaneous areas is paid for as place hot mix asphalt (miscellaneous area) and by weight for hot mix asphalt.

If HMA (miscellaneous area) is shown, the bid item for place hot mix asphalt (miscellaneous area) is limited to the areas shown and is in addition to the bid items for the materials involved.

HMA-SP (Type A) for dike and miscellaneous areas are measured by weight.

Geosynthetic pavement interlayer is measured by the square yard for the actual pavement area covered.

If there is no bid item for tack coat, payment for tack coat for miscellaneous areas is included in payment for the hot mix asphalt used in miscellaneous areas.

The Department does not adjust the unit price for an increase or decrease in the tack coat quantity. Section 9-1.06 does not apply.

If the dispute resolution independent third party determines the Department's test results are correct, the Engineer deducts the independent third party's testing costs from payments. If the independent third party determines your test results are correct, the Department pays the independent third party's testing costs.

40 CONCRETE PAVEMENT

Add between the 1st and 2nd paragraphs in section 40-1.01C(7) of the RSS for section 40:

As an alternative to the inertial profiler and operator certification by the Department, equivalent Texas Transportation Institute certification is accepted if the certification is dated before July 1, 2013 and is not more than 12 months old.

Replace section 40-1.01C(8) of the RSS for section 40 with:

40-1.01C(8) Coefficient of Thermal Expansion

Submit 4 test specimens fabricated from a single sample of concrete for coefficient of thermal expansion testing under AASHTO T 336.

Submit your coefficient of thermal expansion test data at:

<http://169.237.179.13/cte/>

Replace "Reserved" in section 40-1.01D(3) of the RSS for section 40 with:

Your personnel required to attend the prepaving conference must also complete just-in-time-training (JITT) for CRCP. Provide the facility for the training.

At least 5 business days before JITT, submit:

1. Instructor's name and listed experience
2. Training location
3. One copy of:
 - 3.1. Course syllabus
 - 3.2. Handouts
 - 3.3. 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 the electronic mailbox address:

Construction_Engineering_HQ@dot.ca.gov

JITT may be an extension of the prepaving conference and must be:

1. At least 4 hours long
2. Conducted at a mutually agreed place
3. Completed at least 20 days before you start paving activities
4. 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.

The Department reimburses you for 1/2 of the cost for providing the JITT. The Engineer determines the costs under section 9-1.04 except no markups are added. Costs include training materials; facility use; and the JITT instructor's wages including the instructor's travel, lodging, meals and presentation materials. The Department does not pay your costs for attending JITT.

Replace section 40-1.01D(7)(a)(v) of the RSS for section 40 with:

40-1.01D(7)(a)(v) Coefficient of Thermal Expansion Testing

Test for coefficient of thermal expansion under AASHTO T 336. Test at field qualification and at a frequency of 1 test for each 5,000 cu yd of paving but not less than 1 test for projects with less than 5,000 cu yd of concrete. This test is not used for acceptance.

Add to section 40-2.02B of the RSS with:

40-2.02B(1) Concrete Color

Color the concrete with integral, fade resistant mineral oxide or synthetic type color.

Concrete color for CRCP (color) (type 1), CRCP (color) (type 2) and CRCP (color) (exposed aggregate) must be from the same manufacturer shown in the following table or equal:

Description	Davis Colors Manufacturer	Solomon Colors Manufacturer	Scofield Colors Manufacturer
CRCP (Color) (Type 1)	Sunset Rose #160	Venitian Red #45	Sunset Red #SG160-1
CRCP (Color) (Type 2)	Sandstone #5237	Mohave #755	Stetson Buff #5178
CRCP (Color) (Exposed Aggregate)	Pueblo Brown #61078	Bark #385	Westwood Brown #C27

Replace "Reserved" in section 40-2.03A of the RSS with:

40-2.03A Expose Aggregate

Comply with the following:

1. Coarse aggregates must be exposed to a depth of approximately 3/16 inch to 3/8 inch.
2. At the option of the Contractor, a concrete set retarder may be applied to the surface of the concrete after placing, consolidating and finishing of the concrete has been completed. The concrete set retarder must be commercial quality, manufactured specifically for use on top of the concrete surface and must be applied per the manufacturer's recommendations. The retarder must effectively retard the setting time of the cement and fine aggregate matrix deep enough and long enough to allow for aggregate exposure.
3. Care must be taken in placing and consolidating the concrete so that the coarse aggregate remains uniformly distributed throughout the concrete.
4. When the concrete mass has set sufficiently to allow for removing the matrix of cement and fine aggregate, the coarse aggregate must be exposed with water spray, coarse brooming, abrasive blasting, or a combination of these methods. Removal methods must not dislodge or loosen the coarse aggregate from the concrete surface.
5. Immediately after the cement mortar has hardened sufficiently to resist further removal, all cement film and loose material must be cleaned from the exposed aggregate surface with stiff brooms and water.

- 6. Except when operations for exposing the aggregate are underway, concrete shall be cured by the water method in conformance with Section 90-1.03B(2) or with curing compound no.6 in conformance with Section 90-1.03B(3). Areas of concrete where curing compounds are removed during the cure period shall be kept continuously wet until the end of the cure period or until the curing compound is replaced.

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DIVISION VI STRUCTURES

48 TEMPORARY STRUCTURES

Replace section 48-6 with:
48-6 TEMPORARY HAUL BRIDGE

48-6.01 GENERAL

48-6.01A Summary

Section 48-6 includes specifications for constructing a temporary haul bridge to haul material from the area south of the San Luis Rey River to an area north of the river.

You must design, construct, and maintain a temporary haul bridge that:

- 1. Is safe and adequate for the work
- 2. Provides the necessary rigidity
- 3. Supports the loads imposed

48-6.01B Submittals

Submit shop drawings with supporting calculations signed by an engineer who is registered as a civil engineer in the State.

Shop drawings must be reviewed by an independent engineer who is registered as a civil engineer in the State who does not work for the same entity preparing the shop drawings.

48-6.02 MATERIALS

The materials used in the haul bridge construction must be of a quality necessary to sustain the stresses required by your design.

48-6.03 CONSTRUCTION

All bents must be supported on piles. Place no more than 5 bents.

Spread footings are not allowed except at the abutments.

Construct the haul bridge to resist a 100-year storm.

The temporary haul bridge may remain in place for a maximum of 24 months.

Dispose of the temporary haul bridge once it is no longer needed for your construction activities. Remove pilings to at least 10 feet below original ground.

48-6.04 PAYMENT

Not Used

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49 PILING

Add to section 49-1.03:

Expect difficult pile installation due to the conditions shown in the following table:

Pile location		Conditions
Bridge no.	Support location	
57-1234	Abutments	High groundwater, scouring and caving soils, varying rock drilling conditions (alternating soft and hard)
57-1235L/R	Abutments	High groundwater, scouring and caving soils, varying rock drilling conditions (alternating soft and hard)

Replace "Reserved" in section 49-3.02A(4)(b) with:

Schedule and hold a preconstruction meeting for CIDH concrete pile construction (1) at least 5 business days after submitting the pile installation plan and (2) at least 10 days before the start of CIDH concrete pile construction. You must provide a facility for the meeting.

The meeting must include the Engineer, your representatives, and any subcontractors involved in CIDH concrete pile construction.

The purpose of this meeting is to:

1. Establish contacts and communication protocol between you and your representatives, any subcontractors, and the Engineer
2. Review the construction process, acceptance testing, and anomaly mitigation of CIDH concrete piles

The Engineer will conduct the meeting. Be prepared to discuss the following:

1. Pile placement plan, dry and wet
2. Acceptance testing, including gamma-gamma logging, cross-hole sonic logging, and coring
3. *Pile Design Data Form*
4. Mitigation process
5. Timeline and critical path activities
6. Structural, geotechnical, and corrosion design requirements
7. Future meetings, if necessary, for pile mitigation and pile mitigation plan review
8. Safety requirements, including Cal/OSHA and Tunnel Safety Orders

Add to section 49-3.02B(6)(c):

The synthetic slurry must be one of the materials shown in the following table:

Material	Manufacturer
SlurryPro CDP	KB INTERNATIONAL LLC 735 BOARD ST STE 209 CHATTANOOGA TN 37402 (423) 266-6964
Super Mud	PDS CO INC 105 W SHARP ST EL DORADO AR 71731 (870) 863-5707
Shore Pac GCV	CETCO CONSTRUCTION DRILLING PRODUCTS 2870 FORBS AVE HOFFMAN ESTATES IL 60192 (800) 527-9948
Terragel or Novagel Polymer	GEO-TECH SERVICES LLC 220 N. ZAPATA HWY STE 11A-449A LAREDO TX 78043 (210) 259-6386

Use synthetic slurries in compliance with the manufacturer's instructions. Synthetic slurries shown in the above table may not be appropriate for a given job site.

Synthetic slurries must comply with the Department's requirements for synthetic slurries to be included in the above table. The requirements are available from the Offices of Structure Design, P.O. Box 168041, MS# 9-4/11G, Sacramento, CA 95816-8041.

SlurryPro CDP synthetic slurry must comply with the requirements shown in the following table:

SLURRYPRO CDP

Property	Test	Value
Density During drilling	Mud Weight (density), API 13B-1, section 1	≤ 67.0 pcf ^a
Before final cleaning and immediately before placing concrete		≤ 64.0 pcf ^a
Viscosity During drilling	Marsh Funnel and Cup. API 13B-1, section 2.2	50–120 sec/qt
Before final cleaning and immediately before placing concrete		≤ 70 sec/qt
pH	Glass electrode pH meter or pH paper	6.0–11.5
Sand content, percent by volume Before final cleaning and immediately before placing concrete	Sand, API 13B-1, section 5	≤ 0.5 percent

^aIf authorized, you may use slurry in salt water. The allowable density of slurry in salt water may be increased by 2 pcf.

Slurry temperature must be at least 40 degrees F when tested.

Super Mud synthetic slurry must comply with the requirements shown in the following table:

SUPER MUD

Property	Test	Value
Density During drilling	Mud Weight (Density), API 13B-1, section 1	≤ 64.0 pcf ^a
Before final cleaning and immediately before placing concrete		≤ 64.0 pcf ^a
Viscosity During drilling	Marsh Funnel and Cup. API 13B-1, section 2.2	32–60 sec/qt
Before final cleaning and immediately before placing concrete		≤ 60 sec/qt
pH	Glass electrode pH meter or pH paper	8.0–10.0
Sand content, percent by volume Before final cleaning and immediately before placing concrete	Sand, API 13B-1, section 5	≤ 0.5 percent

^aIf authorized, you may use slurry in salt water. The allowable density of slurry in salt water may be increased by 2 pcf.

Slurry temperature must be at least 40 degrees F when tested.

Shore Pac GCV synthetic slurry must comply with the requirements shown in the following table:

SHORE PAC GCV

Property	Test	Value
Density During drilling	Mud Weight (Density), API 13B-1, section 1	≤ 64.0 pcf ^a
Before final cleaning and immediately before placing concrete		≤ 64.0 pcf ^a
Viscosity During drilling	Marsh Funnel and Cup. API 13B-1, section 2.2	33–74 sec/qt
Before final cleaning and immediately before placing concrete		≤ 57 sec/qt
pH	Glass electrode pH meter or pH paper	8.0–11.0
Sand content, percent by volume Before final cleaning and immediately before placing concrete	Sand, API 13B-1, section 5	≤ 0.5 percent

^aIf authorized, you may use slurry in salt water. The allowable density of slurry in salt water may be increased by 2 pcf.

Slurry temperature must be at least 40 degrees F when tested.

Terragel or Novagel Polymer synthetic slurry must comply with the requirements shown in the following table:

TERRAGEL OR NOVAGEL POLYMER

Property	Test	Value
Density During drilling	Mud Weight (Density), API 13B-1, section 1	≤ 67.0 pcf ^a
Before final cleaning and immediately before placing concrete		≤ 64.0 pcf ^a
Viscosity During drilling	Marsh Funnel and Cup. API 13B-1, section 2.2	45–104 sec/qt
Before final cleaning and immediately before placing concrete		≤ 104 sec/qt
pH	Glass electrode pH meter or pH paper	6.0–11.5
Sand content, percent by volume Before final cleaning and immediately before placing concrete	Sand, API 13B-1, section 5	≤ 0.5 percent

^aIf authorized, you may use slurry in salt water. The allowable density of slurry in salt water may be increased by 2 pcf.
Slurry temperature must be at least 40 degrees F when tested.

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50 PRESTRESSING CONCRETE

Add to section 50-1.01A:

The details shown for CIP PS box girder bridges are based on a bonded full length draped tendon prestressing system. For these bridges, you may submit a VECP for an alternative prestressing system using bonded partial length tendons if the proposed system and associated details comply with the following requirements:

1. The proposed system and details must provide moment and shear resistances at least equal to those used for the design of the structure shown.
2. The concrete strength must be at least that shown.
3. Not less than 35 percent of the total prestressing force at any section must be provided by full length draped tendons.
4. Anchorage blocks for partial length tendons must be located such that the blocks will not interfere with the placement of the utility facilities shown or of any future utilities to be placed through openings shown.
5. Temporary prestressing tendons, if used, must be detensioned, and the temporary ducts must be filled with grout before completion of the work. Temporary tendons must be either removed or fully encased in grout before completion of the work.

Upon your request, the Department furnishes you with the demand moments and shears used in the design shown.

Submit shop drawings of the proposed system, including all details and supporting checked calculations.

AA

51 CONCRETE STRUCTURES

Add to section 51-1.01A:

The concrete at abutments, wingwalls/return wall/retaining wall and parapets as shown on the plans must be integrally pigmented colored concrete. The color must match the referee sample located at Br. No. 57-1211, Ostrich Farm Creek Bridge.

Replace "Reserved" in section 51-1.03A with:

Vertical, horizontal, radial, or normal dimensions shown on the typical section are for zero percent cross slope. You may construct superelevated concrete box girder structures with the typical section rotated around the profile grade line in superelevation areas, that have the following characteristics:

1. Sloping exterior girders
2. Straight, uninterrupted cross slope between edges of deck
3. A single profile grade line

For portions of superstructures rotated about the profile grade:

1. Horizontal distances between the profile grade line and the edges of deck must be as shown
2. Girder widths and slab thicknesses must be as shown
3. Interior girder stems must remain vertical

Add to section 51-1.03C(2)(c)(i):

You may use permanent steel deck forms for the deck slabs between the girders of Br. No. 57-1235L/R.

Replace "Reserved" in section 51-7.02 with:

51-7.02A General

51-7.02A(1) Summary

Section 51-7.02 includes specifications for constructing PC drainage inlets.

51-7.02A(2) Definitions

Reserved

51-7.02A(3) Submittals

For inlets with oval or circular cross sections, submit shop drawings with calculations. Shop drawings and calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State. Allow 15 days for the Engineer's review.

Submit field repair procedures and a patching material test sample before repairs are made. Allow 10 days for the Engineer's review.

51-7.02A(4) Quality Control and Assurance

The Engineer may reject PC drainage inlets exhibiting any of the following:

1. Cracks passing through walls more than 1/16 inch wide
2. Nonrepairable honeycombed or spalled areas of more than 6 square inches
3. Noncompliance with reinforcement tolerances or cross sectional area shown
4. Wall or lid less than minimum thickness
5. Internal dimensions less than plan dimensions by 1 percent or 1/2 inch, whichever is greater
6. Defects affecting performance or structural integrity

51-7.02B Materials

51-7.02B(1) General

Nonshrink grout must be a dry, packaged type complying with ASTM C 1107.

Concrete for basin or inlet floors placed in the field must comply with the specifications for minor concrete.

Joint sealant must be butyl-rubber complying with ASTM C 990. Joint primer must be recommended by the joint seal manufacturer.

Resilient connectors must comply with ASTM C 923.

Sand bedding must comply with section 19-3.02E.

Bonding agents must comply with ASTM C 1059, Type II.

51-7.02B(1) Fabrication

If oval or circular shape cross-sections are furnished, they must comply with *AASHTO LRFD Bridge Design Specifications, Fourth Edition with California Amendments*.

Wall and slab thicknesses may be less than the dimensions shown by at most 5 percent or 3/16 inch, whichever is greater.

Reinforcement placement must not vary more than 1/2 inch from the positions shown.

Cure PC drainage inlets under section 90-4.03.

51-7.02C Construction

Repair PC drainage inlet sections to correct damage from handling or manufacturing imperfections before installation.

Center pipes in openings to provide a uniform gap. Seal gaps between the pipe and the inlet opening with nonshrink grout under the grout manufacturer's instructions. For systems designated as watertight, seal these gaps with resilient connectors.

Match fit keyed joints to ensure uniform alignment of walls and lids. Keys are not required at the inlet floor level if the floor is precast integrally with the inlet wall. Seal keyed joint locations with preformed butyl rubber joint sealant. You may seal the upper lid and wall joint with grout.

Clean keyed joint surfaces before installing sealant. Joint surfaces must be free of imperfections that may affect the joint. Use a primer if surface moisture is present. Use a sealant size recommended by the sealant manufacturer. Set joints using sealant to create a uniform bearing surface.

Flat drainage inlet floors must have a field-cast topping layer at least 2 inches thick with a slope of 4:1 (horizontal:vertical) toward the outlet. Use a bonding agent when placing the topping layer. Apply the bonding agent under the manufacturer's instructions.

51-7.02D Payment

Not Used

AA

56 SIGNS

Add to section 56-2:

56-2.06 Mitigation Signs

56-2.06A General

Mitigation signs include sign panels, installation of sign panels, posts and mounting hardware.

56-2.06B Materials

Habitat restoration sign panels must be single sheet aluminum and comply with section 56-2.02.

Other sign panels must be as shown.

59-11.01C Submittals

Submit the following:

- 1. Product data, including the manufacturer's product sheet, MSDS, and instructions for application of the stain
- 2. Certificate of compliance for the stain
- 3. Work plan showing methods to control overspray and spillage and protect adjacent surfaces during staining

59-11.01D Quality Control and Assurance

Apply the stain to a minimum 2-foot-long test section of each of the materials that require stain.

The test section may be a section of the surface to be stained if authorized.

The test section must be:

- 1. Prepared and stained using the same materials, equipment, and methods to be used in the staining work
- 2. Allowed to cure as specified in the manufacturer's instructions
- 3. Authorized before starting the staining work

Notify the Engineer at least 5 business days before staining the test section.

If ordered, prepare and stain additional test sections. If more than 1 additional test section is ordered, this is change order work.

The Engineer uses the authorized test section to determine the acceptability of the staining work.

59-11.02 MATERIALS

The stain must be Natina Steel from Natina Products, LLC.

The quoted price for the stain is \$149.95 per gallon, not including sales tax and delivery.

You may obtain the stain from:

Natina Products, LLC
 PO Box 4563
 Palm Desert, CA 92261
 (877) 762-8462

At the Contractor's option, Natina Products, LLC will provide the materials, labor and equipment to stain the items that require staining at their facility in Mecca, CA. Staining of the chain link fabric will be done by Natina, LLC at the Contractor's yard. The items and prices (excluding shipping and sales tax) are as follows:

- Tubular Steel Gate (Type 1): \$82.00 each
- Tubular Steel Gate (Type 2): \$122.00 each
- Tubular Steel Gate (Type 3):\$89.45
- Wildlife Fence (Type 1): \$1.70 per LF
- Wildlife Fence (Type 2): \$1.70 per LF
- 10' Chain Link Gate (Type CL-6): \$15.95 each
- 4' Chain Link Gate (Type CL-8) \$8.97 each
- 6' Chain Link Gate (Type CL-8) \$12.52 each
- 10' Chain Link Gate (Type CL-8) \$20.95 each

70-8.01B Submittals

Submit the following:

1. Product data including the manufacturer's product sheet and recommendations for installing the gravel stabilizer
2. Five pound sample of gravel

70-8.02 MATERIALS

70-8.02A Gravel Stabilizer

Gravel Stabilizer must be one of the following or approved equal:

Cell-Tek Geosynthetics
2431 Crofton Lane #9
Crofton, MD 21114
(888) 851-0051
Local Dealer: Decorative Stone Solutions
9825 Dogwood Ln.
Escondido, CA 92026
(800) 699-1878
LSG Series Load Support Grid
Model No. LSG-3

Honeycomb Core Company, Ltd.
USA Sales Rep:
michael@core6systems.com
(616) 581-5670
COREgravel Gravel Stabilizer
Model No. 65-45HDR

Boddingtons USA
Fiberweb Inc.
1611 County Road, BW
Suite 102
Roseville, MN 55113
(651) 330-2920
BodPave85 Porous Grass Paving Grids/Permeable Pavement
Part No. 057580

70-8.02B Gravel

Gravel must be one of the following or approved equal:

KRC Rock
700 North Twin Oaks Valley Road
San Marcos, CA 92069
(760) 744-1036
3/8" Carroll Canyon

Southwest Boulder & Stone
5002 2nd Street
Fallbrook, CA 92028
(760) 451-3333
3/8" Mojave Gold

**Replace section 73-5 with:
73-5 PARKING BUMPERS**

73-5.01 GENERAL

Section 73-5 includes specifications for installing parking bumpers.

73-5.02 MATERIALS

Each parking bumper must be a commercially-available precast-concrete unit.

The parking bumper must be 48 inches long, nominally 8 inches wide and 6 inches high with both top longitudinal corners continuously chamfered, and anchor holes located 9 inches from each end. Minor variations in cross-sectional dimensions are acceptable.

Anchor dowels must be bar reinforcement steel, commercially available, 3/4 inch diameter, and 15 inches long.

73-5.03 CONSTRUCTION

Coordinate the arrangement of parking bumpers with the layout of parking stalls and traffic aisles, as shown.

Install dowels such that the tops of the bars are flush with the top of the parking bumper.

73-5.04 PAYMENT

Not used

AA

77 LOCAL INFRASTRUCTURE

**Replace "Reserved" in section 77 with:
77-1 GENERAL**

77-1.01 GENERAL

77-1.01A Summary

Section 77-1 includes general specifications for constructing local infrastructure of the water and sewer facilities.

Notify the Engineer at least 10 days before starting utility work and 14 days if a utility shutdown is required.

Notify the Engineer again at least 72 hours before the required utility shutdowns.

77-1.01B Definitions

NSF: National Sanitation Foundation

NACE: National Association of Corrosion Engineers

NAPF: National Association of Pipe Fabricators

SSPWC: Standard Specifications for Public Works Contracts

77-1.01C Submittals

For submittals, allow 30 days for review.

All materials require a shop drawing submittal, including those on the *"Approved Materials List, Rainbow Municipal Water District"* in the *Information Handout*. Submit the following manufacturer's data:

1. Dimensions
2. Finish

3. Materials
4. Pressure rating

Submit signed certified test results signed by the individual who performed testing work.

Submit signed shoring plans that comply with Section 7-1.02K(6).

Submit dewatering and discharge plans that comply with Section 13-4.01B.

Submit signed CCTV reports for pipelines that comply with Section 15-6.01A(3). Provide 2 copies of complete DVD digital media formatted CCTV inspection to Engineer before contract acceptance.

Submit welding inspection reports with calculations of welded joint design and joint welding details.

Submit shop welder and field welder certifications and qualifications, which comply with AWS C6.1 and AWS D1.1 and ASME Boiler and Pressure Vessel Code.

Submit epoxy protective lining certification that complies with manufacture's recommendation.

Submit manufacturer's guidelines for rapid set mortar.

Submit a set of as-built drawings within 30 days of installation. Each drawing sheet must:

1. Be 22 x 34 inches minimum, image file (.tiff format), and CADD file, if available
2. Be on a minimum of 20 lb paper
3. Have text a minimum nominal height of 5/32 inch

For CCTV Inspection, submit results on DVD media

For cathodic protection, submit manufacturer's data for:

1. Water line flange insulation kits
2. Water line flange internal coating
3. Wax tape system
4. Plastic warning tape
5. Cathodic protection design and installation details

77-1.01D Quality Control and Assurance

77-1.01D(1) General

Quality control and assurance must comply with section 11, these specifications and except as follows:

1. The Engineer must be present during testing.
2. Corrosion technician must be NACE certified.

Installation of epoxy protective lining system must be by certified personnel by the lining system manufacturer.

For connections to existing pipelines, pothole to field verify the location, elevation, pipe material and coatings, visual condition of pipe material, pipe outside diameter, location of push-on gasketed joints which may affect the required connections, before proceeding with the pipeline submittals and installation. This field verification must be performed in the presence of the Engineer.

77-1.01D(2) CCTV Inspection

Perform CCTV inspection under section 15-6.01A(3)(c), and 15-6.01A(3)(f) and 15-6.01A(4)(d) and with the *SSPWC*, section 306-1.4.

77-1.01D(3) Field Welded Joints Test

Welders must be certified under the AWS standard qualification procedures and ASME Boiler and Pressure Vessel Code.

Inspection must be performed by an independent and AWS certified welding inspector. Welds must be visually inspected and 50 percent of welds must comply with ASTM E 165 - 02. Only 1 welder is allowed per weld. During welding, a welding foreman, certified as an AWS welding inspector, must be onsite at times.

Welded joints must remain exposed until inspection has been performed.

Test single-welded lap joint by the liquid penetrant method and double-welded joints by the soap and compressed air test after steel is cool to the touch and before completing joint coating or lining. Only individuals qualified per AWS D1.1 for NDT Level I and working under the NDT Level II or individuals qualified for NDT Level II may perform nondestructive testing. Maintain records of test performed and results of testing for each location.

Chip out defects, weld, and retest the affected section until it shows no leaks or other defects.

77-1.02 MATERIALS

77-1.02A General

For approved materials not specified on the "*Approved Materials List, Rainbow Municipal Water District*" in the *Information Handout*, requirements are specified in section 77.

77-1.02B Structure Backfill

Structure backfill for the trench zone must comply with section 19-3.02B, and as shown, except sand must not be used in the trench zone and backfill materials must not be placed via jetting.

Structural backfill for the area below the pipe zone, and the pipe zone must comply with this specification.

77-1.02C Welded Steel Pipe Casings

77-1.02C(1) General

Steel pipe casings must be butt-welded sheets for straight seam steel casing pipe and comply with the following:

1. ASTM A 36/A 36M, ASTM A 283/ A 283M, Grade D, or ASTM A 568/A 568M, Grade 33
2. Steel casings sized 20 inch or smaller must have a minimum wall thickness of 3/8 inch
3. Steel casings sized larger than 20 inch must have a minimum wall thickness of 1/2 inch
4. All joints must be full penetration butt welds that comply with AWWA C206, AWS D1.1

77-1.02C(2) Casing End Seals

Casing end seals must comply with section 20-4.02B(6) except as follows:

1. Casing end seals must be either a heat shrinkable sleeve type or the mechanical link type.
2. End seals must provide full dielectric isolation and a watertight seal between the casing and the carrier pipes.
3. Heat shrinkable sleeve must have a minimum tensile strength of 2,500 psi and be resistant to abrasion, corrosive gases and be able to tolerate typical expansion and contraction of the casing and carrier pipes.
4. Provide a separate non-conductive support skirt or transition padding that will allow a smooth transition of the heat shrink material from casing to carrier diameter.
5. Articulated mechanical annular seal must include ethylene propylene diene monomer (EPDM) rubber seal elements, non-metallic pressure plates and Type 316B stainless steel nuts and bolts for tightening.

77-1.02D Concrete

Concrete must comply with as follow:

1. Portland cement concrete must comply with *SSPWC*, Sections 201, 202 and 303.
2. Cement for concrete must comply with ASTM C150 Type V.

3. Aggregate for concrete must comply with ASTM C33 and be non-reactive complying with ASTM C289.
4. Concrete must be Class 560-C-3250 as described in SSPWC, Section 201 The maximum water/cement ratio must be 0.53 by weight, and the maximum slump must be 4-inch.
5. Accelerating admixtures if used must comply with ASTM C 494 and not contain calcium chloride.

77-1.02E Warning/Identification Tape

Warning/Identification tape must be 5-mil thick, 6-inches wide, puncture-resistant and must have an elongation of 600 percent.

For pipelines and appurtenances the printed message must be in black.

Ink used to print messages must be permanently fixed to tape with message at 16 to 36-inch intervals.

77-1.02F Rapid Set Mortar

Rapid set mortar must comply with ASTM C928.

The material must meet the following criteria:

1. Set time must comply with ASTM C191 except with a maximum final set time of 45 minutes.
2. Compressive strength must comply with ASTM C109 except as follows:
 - 2.1. 1-hour 2500 psi after final set
 - 2.2. 3-hours 4000 psi
 - 2.3. 7-days 5000 psi
 - 2.4. 28 days 7000 psi
3. Bond strength must comply with ASTM C882 except as follows:
 - 3.1. 1 day 1000 psi
 - 3.2. 28 days 2200 psi
4. Packaged concrete repair materials must comply with ASTM C928.
5. Maximum drying shrinkage at 28 day is 0.05 percent if tested per ASTM C928.
6. The material must be hydraulic cement-based, non-metallic without chlorides, pre-blended requiring only water.

77-1.03 CONSTRUCTION

77-1.03A General

For pipelines installed in embankment areas, construct the roadway embankment to top. Allow 30 days for the embankment to settle before excavating and backfilling pipe trench for areas requiring settlement monitoring.

Do not stockpile, operate vehicles or equipment, and perform work within 10 feet of the centerline of the water line, unless authorized.

Hand-held equipment must be used within 5 feet from the side of and 1 foot above the top of existing water lines.

Do not pave over pipe lines or appurtenances until authorized.

Existing water mains, water services, sewer mains, sewer laterals, and fire hydrants must be operational during construction activities.

Excavate and backfill under section 19-3.03 except bedding and backfill materials for the pipe zone must comply with this section and as shown..

Do not connect the potable water system to a non-potable water system including the recycled water system.

Abandon pipe lines under section 15-2.05C, and fill pipe with slurry.

77-1.03B Perform Field Welded Joints

During welding, an AWS certified welding inspector must be present.

Field welded joint must be single-welded lap joint or butt-strap closure as shown.

The minimum overlap of the assembled lap joint must be 3 inches and at butt-straps must be 4 inches.

For pipe diameters less than 24 inches the exterior of the joint must be welded. For pipe diameter 24 inches and larger, the joint must be welded under the approved submittal.

Weld material must be deposited in successive layers. Complete and clean each pass around the entire circumference of the pipe before commencing the next pass.

To minimize longitudinal stresses due to temperature variations, leave one unwelded joint per 400 feet of pipeline. This joint must be left unwelded until the joints on both sides of it are welded, and it must be welded at the coolest time of the day. The Engineer must decide if and where this procedure is warranted.

Tack-welding the joint is allowed to hold the pipe in place. Tack welding cannot be part of the root weld and must be removed before joint welding. If the joint is to be circumferentially welded, sufficient time must elapse to allow for an initial set of interior joint lining before proceeding with joint welding. Rapid-setting mortar must be used. Hand holes are required.

Welded joints must be completed in the trench and comply with AWWA C206, except as modified herein.

Welding, welder qualifications, and inspection of welding must comply with ASME "*Boiler and Pressure Vessel Code*". Welder must be qualified for the process within the past 3 years.

If joint laying surfaces are rusted or pitted where weld metal is to be deposited, clean them by wire brushing or abrasive blast cleaning.

Fillet welds must be applied to the exterior joint of lap welded pipe or butt-strap closures in successive layers of weld material. The minimum overlap of the assembled lap joint must be 3 inches. Minimum size of fillet weld must be equal to the steel cylinder thickness. Complete each pass around the entire circumference of the pipe before beginning the next pass. Do not deposit more than 1/8 inch of throat thickness per pass. Provide a minimum of 2 of passes or beads in the completed weld for steel cylinder thickness 1/4-inch and less, and a minimum of 3 passes for steel cylinder thickness greater than 1/4 inch.

Clean each layer of deposited weld material before depositing the next layer of weld material, including the final pass, by a power-driven wire brush.

Preheat the joints to be welded as required per Table 1 of AWWA C206.

Welding must be done by either the shielded metal arc welding (SMAW) or flex cored gas shielded (FCAW-G) method. The SMAW method must be used on welds on the exterior side of the pipe joint. Either the SMAW or the FCAW-G method may be used on welds on the interior side of the pipe joint.

The air velocity near the weld must not exceed 5 mph if the FCAW-G method is used. SMAW must be applied by continuous stringer beads, with a maximum electrode diameter of 5/32 inch regardless of welding position.

For SMAW method, maximum bead width must be 2-1/2 times the electrode diameter and maximum bead thickness must be 1/8 inch. The electrode used on the root pass must be E-6010 run downhill. Use E-7018 electrodes run uphill for the remaining passes.

FCAW-G must use an external shielding gas per AWS A5.20, Table 2, and the electrode recommended by the pipe manufacturer.

FCAW-G is applied by continuous stringer beads run uphill. The maximum electrode diameter for FCAW-G must be 5/64 inch.

Do not start welding until fit-up has been accepted in writing. Complete and clean each pass around the entire circumference of the pipe or along the seam of the pipe before commencing the next pass. Completed fillet welds must be convex.

During welding of exterior joints, protect the welded steel water line coating by draping an 18-inch wide strip of heat-resistant material around the circumference of the pipe on each side of the coating holdback. Do not use the coated part of the pipe for ground.

Comply with the requirements in ASTM E 165. Materials provided must be either water washable or nonflammable. Materials must be "Spotcheck" by the Magnaflux Corporation or "Met-L-Check Flaw-Finder" by the Met-L-Check Company.

77-1.03C Construct Cathodic Protection System

77-1.03C(1) General

Construct cathodic protection system on buried steel pipes.

Cathodic protection system must be constructed by a NACE certified cathodic protection specialist.

The installation of corrosion control and monitoring facilities must comply with NACE International Standard Practice SP0169 "*Control of External Corrosion on Underground and Submerged Metallic Piping Systems*" and NACE RP0286 "*Electrical Isolation of Cathodically Protected Pipelines*".

77-1.03C(2) Install Anode

Remove the impervious wrapping around the cloth bag of packaged anode before installing the anode.

Install the anode using the following sequence:

1. After the anode hole is drilled, 20 gallons of water must be added and allowed to sit for 1 hour.
2. The anode will be soaked in water for 30 minutes before it is lowered into the hole.
3. Ensure that the anode is never lifted, supported, transported, or handled by the lead wire.
4. Anodes must be lowered into hole using a sling or rope.
5. Add an additional 15 gallons of water to cover the top of the anode before filling the hole.
6. The open circuit potential of the high potential magnesium anode must measure between 1.65–1.75 volts.
7. Notify the Engineer 72 hours in advance, to witness the installation and testing of the anodes.

The packaged anode must be wetted thoroughly before backfilling. Backfill material placed to 12 inches above the anode must be native soil, free from aggregate larger than 1/2-inch in size.

Conductors must be direct buried and located safely from construction activities.

Wrap metals connected to the cathodic protection system.

Isolate cathodically protected metals from other metals.

77-1.03D Install Warning/Identification Tape

Warning tape must be used on all underground pipelines.

Warning tape at the top of the pipe zone 12-inch above and centered over the utility intended for identification.

77-1.03E CCTV Inspection

Perform CCTV inspection under section 15-6.01C(3) and with SSPWC Section 306-1.4.

Perform CCTV inspection after water and sewer lines have been installed, backfilled, and compacted, but before final paving.

Perform CCTV inspection of existing sewer lines before earthwork and after final paving.

Notify the Engineer 72 hours before CCTV inspection.

CCTV inspection and reports must be performed by an authorized Pipeline Assessment & Certification Program person from an accredited program with the National Association of Sewer Service Companies.

Repair structural cracking, correct excessively deflected joints, sags, remove protruding joint sealing material, corrosion, and other defects revealed by the CCTV inspection.

Inspect reworked areas with CCTV and submit results.

77-1.03F Rapid Set Mortar

Use rapid set mortar to repair all interior and exterior potable water pipeline coatings, and to repair sewer manhole bases and shafts. Place rapid set mortar in accordance with the manufacturer's recommendations and as follows:

1. Steel surfaces to be mortar coated must be free from rust and materials that will inhibit bond.
2. Concrete surface must be in a saturated, surface dry (SSD) condition.
3. Apply the mixed repair mortar into all surfaces.
4. Consolidate full thickness repair to remove voids.
5. Water cure.

77-1.03G Structure Excavation and Backfill

Structural excavation and backfill must comply with section 19-3 and 19-5 and as shown except as follows:

1. Structural Excavation and Compaction
 - 1.1. Relative compaction below sewer manholes, sewer lines, waterlines, and within the pipe zone must be 90 percent.
 - 1.2. Over excavation is required in the pipe-zone as shown.
 - 1.3. If encounter unsuitable material and over-excavation is required, refill the over-excavated area with 3/4-inch rock. Place the refilling material over the full width of trench in compacted layers not exceeding 6-inches deep to the established grade with allowance for the pipe base and fittings.
2. Place bedding under Section 19-3.03H except as follows.
 - 2.1. Place the thickness of pipe bedding material over the full width of trench and compact, as shown.
 - 2.2. The minimum thickness of bedding must be 12 inches.
 - 2.3. Grade the top of the pipe base ahead of the pipe laying to provide firm, continuous, uniform support along the full length of the trench for the pipe, fittings, valves, and manhole bases.
 - 2.4. Excavate bell holes at each joint to allow proper assembly and inspection of the entire joint. Fill and compact the area excavated for the joints with the pipe base material.
3. Backfill
 - 3.1. Prevent free fall of the material to the specified relative compaction by mechanical compaction in layers not exceeding 8 inches of compacted thickness at optimum moisture content.
 - 3.2. Do not use heavy duty compaction equipment with an overall weight in excess of 125 pounds until backfill has been completed to a depth of 2 feet over the top of pipe. Do not use high impact hammer type equipment except where the pipe manufacturer warrants in writing that such use will not damage the pipe. Remove excess excavated material offsite.
 - 3.3. Remove excess excavated material offsite.
 - 3.4. After the pipelines have been bedded and where applicable, place specified fill material in the pipe zone simultaneously on both sides of the pipelines and manholes, keeping the level of backfill the same on each side. Carefully place the material around the pipe so that the pipe barrel is completely supported and that no voids or un-compacted areas are left beneath the pipe. Place material on the underside of the pipe to prevent lateral movement during subsequent backfilling. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe. Compact backfill material in the trench zone above the pipe zone to the relative compaction by mechanical compaction or hand tamping.

77-1.03H Concrete Encasement

Construct concrete encasements as shown and under section 51 except as follows:

1. Place concrete between the undisturbed ground and the pipe or restrained or supported fittings.
2. Place concrete such that the pipe joints, fittings, or appurtenances are accessible for repairs.
3. Spade or rod the concrete during placement to eliminate honeycombing.

4. Provide temporary support on the pipe, fittings, or appurtenances until the concrete has obtained a 3 day cure.
5. Backfilling adjacent to the concrete is only allowed after it is cured for at least 3 days.
6. Allow concrete to cure for at least 7 days before pipeline is pressurized.

77-1.03I Dewatering Trench

Dewatering trench must comply with section 13 and 19-3.03D except the dewatering system must lower the water surface to a depth of 3 feet below the lowest excavation depth.

77-1.03J Construct Welded Steel Casing

Construct steel casing under section 49-3.02C(5).

Impact and vibratory hammers must not be used.

If the drilled holes are constructed using slurry displacement method, the slurry must be of mineral or synthetic slurry. Use of water is not allowed as slurry.

Construct welded steel for pipe materials, pipe supports, welding, air blown sand, casing spacers, flanges, specials, and connections.

Casing must be installed, with casing spacers as shown.

Pipe casing joints must be full penetration butt welds under AWWA C206, AWS D1.1 and this section.

Casing spacers must be used to prevent the pipe bell from touching the casing and maintain a uniform space between the pipe and casing interior.

Install casing insulators to manufacture's recommendations and as determined by your engineer.

Install heat shrinkage or mechanical link seals to manufacture's recommendations. Seal must be watertight.

77-1.04 PAYMENT

Not Used

77-2 WATER

77-2.01 General

Section 77-2 includes specifications for constructing, removing, abandoning, and relocating existing water facilities.

77-2.01A Submittals

For the steel pipe and its elements that require special detailing, submit the following before fabrication:

1. Certificate of compliance of pipes, appurtenances and fittings comply with the AWWA listed herein.
2. Certification of dye penetrant shop-weld testing of shop-welds and for welded steel casing joints.
3. Typical details and description of lining and coating.
4. Calculations supporting selected wall thickness of pipe and specials including elbows, short pipe pieces, reducers, tees, crosses, spools, sections with outlets, beveled sections, sizing of reinforcing collar plates, wrapper plates and crotch plates. Calculations showing that each proposed restrained joint arrangement can resist the applied forces.
5. Mill test reports on each heat from which steel is rolled.
6. Test Reports for linings and coatings including ASTM C150 Type V for the cement and ASTM C33 and C289 for the fine and coarse aggregates.
7. Positive identification by pot hole of existing water line for connection points.
8. Painting quality work plan under section 59-2.01C(3).
9. Submit a chart of the manufacturer's available colors for color selection well in advance of painting operation.

10. Disinfection and de-chlorination plan, including methods and equipment to be used signed by a CA Department of Public Health Grade D2 water distribution operator or T2 water treatment certified technician. Submit the qualifications of the personnel performing disinfection. The technician must have a minimum of five years of experience in the chlorination and de-chlorination of similar diameter and length pipelines.
11. A Record of Disinfection must be provided to the Engineer before sampling and must include time of bottom of water line elevation at each change of grade, size, class, and alignment. Elements of curves and bends, both in horizontal and vertical alignment.
12. Pipe internal injection, length of injection, and log of disinfection.
13. NACE certificates for the coating adhesion and thickness tester.
14. Separate shop drawing of each connection, detailing demolition, new water line and shop field measured information with a tabulated layout including:
 - 14.1. Direction of laying, order of installation, and utility closures including cut-to-fit allowances for length adjustment and construction convenience.
 - 14.2. Water line station and diameter, wall thickness, and pressure class.
 - 14.3. Locations of bulkheads for field hydrostatic testing.
 - 14.4. Locations of valves, flanges, appurtenances and related mechanical equipment.
 - 14.5. Location of hand holes for closure sections.
 - 14.6. Location of a change in size, class, alignment, or grade
 - 14.7. Details of the specials including elbows, short pipe pieces, reducers, tees, crosses spools, sections with outlets, beveled sections, including the lining and coating.
 - 14.8. Joint details.

Coating adhesion and thickness tests must be performed by and the NACE certified coating inspector and submit before installation.

Allow 30 days for review.

77-2.01B Quality Control and Assurance

77-2.01B(1) General

Flush lines, perform hydrostatic pressure testing, and disinfect the new water pipelines in the presence of the Engineer.

Field and shop welders must be certified under AWS D1.1 and ASME.

Only the utility owner can operate existing valves. The utility owner will close valves to isolate water system before you commence work.

After you have successfully flushed, pressure tested, disinfected and constructed the new and relocated water system improvements, notify the Engineer.

77-2.01B(2) Hydrostatic Testing of Pressurized Water Lines

Notify the Engineer at least 5 business days before performing pressure test. Perform pressure testing on Tuesday and Thursday between 8 a.m. and 4 p.m.

Before pressure testing water lines, all piping, valves, fire hydrants, services, and appurtenances must be installed and opened.

Before testing, compact and backfill the water line trench to a minimum of 2-1/2-feet above the top of water line.

The discharge of water must comply with San Diego RWQCD requirements.

Concrete anchors, thrust blocks, and encasements must cure for a minimum strength of 2,000 psi before testing.

Steel pipelines must not be tested until mortar lining and coating have been in place for a minimum of 14 days. Cement-mortar lined joints must not be tested until a minimum of eight hours has elapsed after the last joint has been mortared.

Testing water must be supplied through a metered connection equipped with an approved backflow prevention device at the point of connection to the potable water source used. Provide temporary piping needed to deliver potable water to the piping that is to be tested. For cement mortar water lines, fill with water and placed under a minimum pressure of 25 psi for a minimum of 2 days before the hydrostatic test.

A 5 hour hydrostatic pressure test must be performed. The test pressure must be 50 psi above the class rating of the pipe at the lowest point in the section being tested and must be at least equal to the design class of the pipe at the highest point in the line.

The test pressure must be applied and maintained by pumping for a period of 4 hours. During pumping, the test pressure must be maintained within 5 psig of the specified test pressure.

At the end of the 4th hour, the pressure must meet the requirements stated above. Pumping must then be discontinued for 1 hour and the drop in pressure must be recorded. Pumping must then be resumed to restore the initial test pressure, and the quantity of water pumped into the line must be measured.

No leaks are allowed in steel water line with welded joints.

The maximum allowable leakage in gallons/hour for PVC, steel, and ductile iron pipe with rubber joints is:

$$L = \frac{S \times D \times (P)^{0.5}}{133,200}$$

Where:

- L = Maximum allowable leakage in gallons per hour for section of water line tested
- S = length of pipe tested in feet
- D = nominal diameter of pipe in inches
- P = average test pressure during test in psi

If the rate of water loss during the test exceeds the calculated rate, locate the leak and repair. After repair, perform additional tests until passing. Leaks are repaired at your expense.

77-2.01B(3) Disinfection

You must perform disinfection on the newly completed water system before connecting to the existing potable water system under AWWA C651 and NSF 61 except as follows:

1. Perform disinfection testing after passing the hydrostatic testing of waterlines.
2. During disinfection, exercise all valves.
3. Use only liquid sodium hypochlorite solution for disinfection. Disinfection must result in an initial total chlorine concentration of 50 to 150 ppm. This concentration must be evenly distributed throughout the system to be disinfected. This includes the main pipeline, the appurtenances, hydrants, backflow prevention devices, and water service laterals.

Backflow protection is required and the new water main must be kept isolated from the active distribution system using a physical separation until satisfactory bacteriological testing has been completed and the disinfectant water flushed out.

The system must contain a total chlorine residual of not less than 80 percent of the initial total chlorine residual before the 24 hour soaking period began. If the total chlorine residual has decreased by more than 20 percent, the system must be soaked for an additional 24-hour period. If the total chlorine residual has not decreased after this additional 24-hour period, the system must be flushed under the procedure detailed herein. If the total chlorine residual has decreased by more than 20 percent, the system must be flushed under the procedure detailed herein, and must be re-disinfected.

Following a successful retention period, the chlorinated water must be flushed from the system at its extremities and at each appurtenance using potable water. The minimum water velocity during flushing must be 3 feet per second or as ordered by the Engineer. Flushing must continue until the replacement water in the new system is equal in chlorine residual to the potable source of supply as verified by the Engineer.

A chlorine reducing agent must be applied to the water before exiting the piping system. The treatment operator must monitor the chlorine residual during the discharge operations. Total residual chlorine limits in these locations, and for the discharge of chlorinated water from the testing of pipelines to surface waters of the San Diego Region at 0.02 ppm maximum.

The utility owner must perform bacteriological sampling and testing of new system installations. The testing methodology used must comply with AWA 651 for coliform bacteria and heterotrophic plate count. The certified laboratory must analyze the samples for the presence of coliform bacteria and heterotrophic-type bacteria count.

If the initial disinfection fails to produce satisfactory bacteriological test results re-disinfection and retesting must be paid by you at no additional expense.

77-2.01B(4) Dry-Film Thickness Testing and Repair

Provide dry-film thickness gauge and electrical flaw detection equipment. Perform the holiday, pinholes, and monitor wet film measurements throughout the application of each coat of coating. Testing must be done in the presence of the Engineer under NACE RP 0188 / RP 0490 at 100 volts per dry-film thickness mil. Measurement must not be made until a minimum of eight hours after application of the coating.

Repair damaged or defective coatings to the satisfaction of the Engineer.

77-2.01B(5) Soil Testing

Soils testing must comply with section 19-3.02E(2) and soils must have a pH within the range of 6.0 to 8.5, a resistivity of 2,000 ohm-cm, or greater, and a soluble sulfate content of 500 ppm or less.

Soils samples must be collected at spring line of the proposed alignment, and chemically analyzed by qualified laboratory for pH, soluble chlorides and sulfate ions, resistivity, and oxidation-reduction potential based on the test methods:

Property	Test method
pH	ASTM G51
Soluble sulfate ion	ASTM D516
Soluble chloride ion	ASTM D512
Resistivity	ASTM G57
Oxidation-reduction potential	ASTM D1498

77-2.01B(6) Inspection of Polyethylene Tape

Holiday test the polyethylene tape. Repair defective areas to the satisfaction of the Engineer. If the area tests show no holiday, a notation must be applied to the area indicating the test is satisfactory.

Coating repair for polyethylene tape coated and mortar over-coated pipe, if damaged. The damaged area must be subjected to an electrical holiday test of 6,000 to 7,000 volts. If the holiday test indicates failure of the coating system, the coating must be repaired and re-tested.

Following repair of the damaged area if the holiday test indicates a holiday still exists, the inner wrap of the taped joint must be exposed and the exposed area must be wiped clean with xylol solvent, or equal, and the area coated with tape primer. A patch of 35-mil thick cold-applied tape of sufficient size to cover the damaged area, plus a minimum lap of 2 inches in directions, must then be applied. The patched area must again be tested for holidays. If none are detected, a second layer of 35-mil thick tape must then be applied over the first patch. The second layer of tape must overlap the first layer a minimum of 23 inches in directions. For polyurethane coated joints, the joint repair process must be repeated.

77-2.01B(7) Insulating Flanges

Insulating flanges must be tested by a qualified NACE International trained and certified Cathodic Protection Level 2 corrosion technician or California registered corrosion engineer and accepted by the Engineer. Buried insulating flanges must be tested before wax tape wrap coating and backfilling.

77-2.01B(8) Connect to Existing System.

Authorization for connection to the existing system will be given only on the basis of acceptable hydrostatic, disinfection and bacteriological test results.

Connections to the existing water system must be completed in the shortest practicable time.

Make connections to the existing water system Tuesday through Thursday between 8 a.m. and 4 p.m.

77-2.02 Material

77-2.02A General

Steel pipe must comply with AWWA C200. The steel for the cylinder must comply with ASTM A36 with a minimum of 300 psi working pressure and 36,000 psi minimum yield strength.

All buried steel pipe must have reinforced cement mortar coating.

At butt-strap joints, 5-inch minimum hand holes are required, unless authorized, to facilitate interior lining repairs at joints in the field.

After the welding is completed, the outside annular spaces between pipe sections must be completely filled with grout. The grout must be poured such that the exposed portions of the metal joints are completely covered with cement mortar. Grout used on the outside of joints must be non-shrink grout, sufficiently fluid to be poured down one side of the pipe and allowed to flow up the other side. The outside mortar joints must be formed by heavy-duty diapers or grout bands.

Circumferential steel bar or wire reinforcement must comply with ASTM A615, Grade 60.

Wire fabric reinforcing for cement-mortar coatings and linings of fittings must comply with ASTM A185, or ASTM A497.

Spiral-wire reinforcement for cement-mortar coatings must comply with ASTM A82.

Pipes and buried appurtenances must be painted at the manufacture's plant and comply with section 59 and 91, AWWA C210, C213, C116/A21.16, C550.

77-2.02B Pipe Wrapping

Ductile iron pipe and appurtenances must be fully wrapped in 8 mil polyethylene sheet material under AWWA C105 Method A.

The plastic encasement must be installed without pinholes or tears and must be protected from damage during backfilling. Pipe sections must be inspected by the Engineer before the pipe is backfilled.

77-2.02C Painting and Coating

Painting and Coating must comply with section 59 and 91, SSPC "*Steel Structures Paint Council, Surfaces Preparation Specifications, ANSI A159.1*", AWWA C210, C213, C116/A21.16, C550, except as follows:

1. Fusion bonded epoxy must be dry powder epoxy resin. Preapproved manufacturers are as follows:
 - 1.1. Ameron Corrosion Control Division, Brea, CA
 - 1.2. ICI Devoe Coatings, Strongsville, OH
 - 1.3. Tnemec Company, Inc., Kansas City, MO, 64141
2. For field touch-up of shop-applied organic zinc prime coats, organic zinc coating system must have a minimum volume solids of 62 percent and a minimum zinc dust content of 83 percent by weight in the dried film. Coating must be of urethane type.

77-2.02D Bedding

Pipe zone bedding for potable water pipes must comply with section 19-3.02E(2) except as follows:

1. Waterline pipe zone back fill must be sand and must have a pH from 6.0 to 8.5, a resistivity of 2,000 ohm-cm, or greater, and a soluble sulfate content of 500 ppm or less.

2. Bedding and pipe zone back fill material must have a sand equivalent of not less than 30 and an expansion coefficient of not more than 1/2 percent if saturated with water. Imported sand must have the following gradation:

Sieve Size	Percentage passing
3/8 inch	100
No.4	75-100
No.30	12-50
No.100	5-20
No.200	0-15

77-2.02E Cement Mortar Lined and Coated Steel Pipe Specials and Fittings

Fittings for steel pipe must comply with AWWA C208.

Fittings must be segmentally welded sections of hydrostatically tested pipe, with ends compatible for type of joints as shown.

The minimum radius of elbows must be 2.5 times the pipe diameter.

The maximum miter angle on each section of elbow must not exceed 11.25 degrees.

Fittings must be equal in pressure design strength and must have the same lining and coating as the abutting pipe.

Linings or coatings must be continuous to the end of the pipe or back of the flange.

Flange faces must be shop cloth-inserted rubber.

Bolts on buried flanges must be ASTM A276 Type 316 stainless steel with coal tar epoxy applied after installation.

Steel for bell rings must comply with ASTM A575.

Steel for spigot rings must comply with ASTM A576.

77-2.02F Cement Mortar Lined and Coated Steel Flanges

Steel flanged joint must be made with welding neck or slip on type flanges welded to the pipe.

Flange must comply with AWWA C207 Class F.

Pipe end with flange must have the weld bead on the pipe ground flush for the flange to slip over the end. Weld flange to the pipe end with full fillet weld both inside and outside.

For flange with an insulating kit, the pipe flange bolt holes must be oversized and comply with AWWA C207, Section 4.2.3, to accommodate the insulating sleeves.

Shop coat the machined faces of flanges with rust-preventative compound.

The inside of blind flanges must be cement-mortar coated. The thickness must be the same as the cement-mortar lining for pipe.

77-2.02G Shop-Applied and In-Place Applied Cement Mortar Lining and Coating

Welded steel pipe and mill-type steel pipe must be cement mortar lined and coated under AWWA C205, "Standard for Cement Mortar Protective Lining and Coating for Steel Water Pipe, 4-inches and Larger Shop Applied," or AWWA C602, "Standard for Cement Mortar Protective Lining and Coating for Steel Water Pipe, 4-inches and Larger – in Place," with thickness as follow.

1. The minimum thickness of cement mortar lining over steel pipe and specials must be 5/16 for pipe sizes 4 to 12 inches, and 3/4 inches for larger pipelines.
2. The minimum thickness of cement mortar coating over metal surfaces of pipe and specials is 1 inch, except at flanges.

3. Coating within one bolt length of a flange must be 50 percent of the above thickness.
4. The coating must be reinforced with spirally wound No. 14 gauge steel wire spaced at 1-1/2-inch centers positioned at the center of the mortar coating.

77-2.02H Insulating Flange Kits

Insulating flange kits must consist of DIN EN 1092-1 Type E, full face gaskets, insulating sleeves and double washers with steel and dielectric on each end.

Insulating material must meet manufacture recommendation for the operating temperature and pressure of the service. Insulating gaskets must be dielectric neoprene faced phenolic. The sealing surfaces of both flanges must be compatible with the gasket.

Use full-length sleeves except for installation on threaded studs where half-length sleeves are required. For installation on threaded bolts, such as at butterfly valve flange bonnets and bases, the sleeves must be half-length. Use 1/32-inch thick grade G10 epoxy glass tube material as per National Electrical Manufacturers Association (NEMA) LI-1 unless authorized.

77-2.02I Wax Tape Wrap

Buried pipe system surfaces including spools and fittings not coated with the primary pipe coating must be prime coated and wax tape wrapped complying with AWWA C217.

77-2.02J Ductile Iron Pipe and Fittings

Ductile-iron pipe and fittings must comply with AWWA C110, C111, C115, C150, C151, and C153, except gray-iron and cast-iron fittings or flanges must not be used.

Use ductile iron fittings for pipes 12 inch and smaller.

Joints for ductile-iron pipe and fittings must be mechanical, flanged, or push-on and comply with AWWA C110, C111, and C153.

Joints for ductile-iron pipe and ductile-iron fittings must have a pressure rating equal to or greater than the adjacent pipes, unless authorized.

Buried pipe joints may be of the push-on, flanged or mechanical-joint type under AWWA C111 except as shown.

Above ground joints or joints within structure must be flanged.

Ductile-iron flanges must comply with AWWA C115, rated and must have a minimum working pressure of 300 psi.

Ductile-iron flanges must be compatible with the steel mating flange of the adjacent appurtenances, or as shown.

Maximum working pressure of flanges must comply with AWWA or ASME/ANSI. Flanges must be integrally cast under AWWA C110 or shop-threaded under AWWA C115. Flanges must be solid. Hollow-back flanges are not permitted. Gray-iron or cast-iron flanges are not permitted.

If threaded flanges are used, the pipe or spool piece to which they are connected must be hydrostatically tested before installation. The pipe section or spool piece must be hydrostatically tested for 15 minutes at the pressure rating of the flanges. No leaks are permitted.

Plain ends must comply with AWWA C151 and to the dimensions included within AWWA C110 to accept a mechanical joint, push-on joint, flanged coupling adaptor, flexible coupling, or grooved coupling.

The exterior surfaces of pipe and fittings must be factory coated with a minimum 1 mil thick petroleum asphaltic material that comply with AWWA C110 and C151.

Pipe and fittings must be cement-mortar lined under AWWA C104, except use the double the thickness of Type II or Type V fittings, and must have a home mark on the spigot end to indicate proper penetration when the joint is made.

Delivery, storage, and handling of ductile-iron fittings must comply with AWWA C600 and the following:

1. Gaskets must be stored in a cool location out of direct sunlight. Bolt, nuts, and washers must be stored in a dry location.
2. Plastic end caps must be kept on fittings and kept in good condition. Periodically open the plastic end caps and spray clean potable water inside for moisture control.
3. Ropes or other handling devices must not be attached through the interior of fittings.

External fitting coating must be 3-parts wax tape per AWWA C217 for fittings and short pipe runs.

Surface preparation must comply with NAPF 500-03.

Pipe must be delivered and stored in the field in a safe location with pipe openings covered with plastic.

Mechanically restrained joints must have boltless positive lock ring type joints such as by U.S. Pipe TR Flex, American Pipe Lok Ring, Megalug or equal. The design must allow disassembling of the joint for repair and maintenance. External type harnesses and internal type restraints are prohibited.

77-2.02K Gaskets, Bolts and Nuts

Mechanical joint rubber gasket must comply with AWWA C111.

Flange gaskets must be 1/8-inch thick acrylic or aramid fibers bound with nitrile for sizes of pipe. Gaskets must be full-face type with pre-punched holes. Ring gaskets extending to the inner edge of the bolt circumference may be used only on approval.

If a metallic nonferrous pipe or appurtenance is connected to ferrous pipe or appurtenance, an insulating flange gasket kit must be provided. Each insulating gasket must have a pressure rating equal to or exceeding the connecting pipes.

Push-on joint rubber gaskets must comply with AWWA C111.

If organic solvents or petroleum products are encountered during the course of the work, alternate gasket materials or joint treatment is required.

Bolts must be of such length that not less than 1/4-inch or more than 1/2-inch projects past the nut in tightened position.

77-2.02L Copper Pipes, Brass Pipes, Copper-Brass and Bronze Fittings

77-2.02L(1) General

All parts in contact with potable water must be fabricated from an approved no lead/ultra-low lead material containing residual lead levels certified as not exceeding 0.25 percent weighted average lead content under Health and Safety Code Section 116875 and meeting the requirements of NSF 61 annex G or NSF 372.

77-2.02L(2) Copper Pipes

Copper pipe and fittings must comply with section 20-3.02M(1) except as follows:

1. Copper pipes up to 1-inch diameter must be soft
2. Pipes 1-inches or greater in diameter may be soft if pressures are 150 psi and less.

77-2.02L(3) Brass Pipes and Fittings

Threaded nipples, brass pipe and fittings must comply with ASTM B43. Threads must comply with ANSI B1.20. 1. Fittings must be compression type. Brass pipe must not contain lead material.

Fittings must be threaded type.

Brass pipe and fittings must be manufactured of bronze under ASTM B62.

Service saddles must be the double strap type. Service saddles must be used on service and appurtenance connections to PVC piping. For piping materials other than PVC, service and appurtenance connections must be performed.

77-2.02M Valves

77-2.02M(1) General

Valves must be delivered and stored in the field in a safe location with the port openings covered with plastic, cardboard or wood. These covers must remain in place until the valve is ready to be installed. Do not stack valves on top of each other or place in contact with bare ground.

77-2.02M(2) Combination Air Release and Air/Vacuum Valves

Combination air release and vacuum valves must comply with AWWA C512.

Combination air/vacuum assemblies must be installed on pipe no closer than 18 inches to a bell, joint or fitting.

Assemblies must be installed above ground with a sanitary vent screen to the exhaust port of the valve.

Assemblies installed must have an isolation valve to allow future maintenance. Isolation valves installed above ground must have locking capability. Isolation valves installed below ground must have a debris cap with a locking device.

77-2.02M(3) Plug Valves

Plug valves must comply with AWWA C517 except as follows.

1. Must be concentric, non-lubricated and tapered
2. Must be suitable for water service.
3. Must be top entry, bolted gland.
4. Must have cast iron bodies and tapered plugs with bolted ductile iron, malleable iron, or steel covers
5. Weld repair of iron castings is not permitted.

A flexible, stainless steel diaphragm must be provided under the valve cover, and must bear against the top of the plug to provide a primary stem seal mechanism. The valve cover must be sealed to the body by non-asbestos containing gaskets loaded in place by cap screws.

A gland assembly must be provided to control plug adjustment without working through compressible packing and must not allow adjustment to be lost due to packing compression over time. Gland assembly must have nitrile elastomer O-ring seals, which bear against the plug shank and the valve cover, as a provision for a secondary stem seal mechanism.

Enclosed worm gear operators must be furnished. Wrench operated valves must be available if specified on certain smaller sized valves. Gear operators must be a part of the valve design and must provide for basic isolation of the valve adjustment gland, valve stops, from the general environment. Where specified, gearing must be furnished as a tightly sealed waterproof design capable of withstanding 15-foot head of water, and such design must serve to protect the gland, and gland adjusting mechanism from the environment. Gearing must consist of a ductile iron segment keyed to the valve stem.

The segment must be driven by a hardened steel worm gear. Both the segment and the worm gear must be dry film lubricated with molybdenum disulfide. The worm gear must be attached to an input shaft, which is supported by thrust bearings. The gearing must be lubricated by high quality extreme pressure gear grease.

Valve must comply with Valve Manufacturer's Standardization Society Specification MSS SP-78; Cast Iron Plug Valves; Flanged and Threaded Ends. The valve must comply with the standards ANSI B16.1, ANSI B1.20.1, ASTM A126, Class B, MSS SP-6, MSS SP-25, and AWWA C110/A21.10-87. Face to face dimensions must comply with ANSI B16.10.

Provide a 5-year warranty against defects in materials and workmanship from the valve manufacturer.

The valves must be a venturi pattern design, and range in size from 6 to 24 inch. The valves must be rated for a minimum working pressure of 400 psi cold working pressure (CWP) for sizes 6 to 12 inch, and 300 psi CWP for sizes 14 to 24 inch. The valves must be hydrostatically shell pressure tested at twice the CWP rating. Each valve seat must be tested at 150 percent CWP pressure instead of the SP-78 specified 110 percent CWP. The valve must have flanged ends drilled to ANSI Class 250 Cast Iron Flange Templates.

77-2.02N Valve Can, Lid and Extension Stem

The valve box lid for a potable water line must be painted white or blue and must be cast with the letters "WATER" for potable water and "RMWD" with one line of text on top.

Valve nut 10-feet or more below finished grade, provide a valve stem extension.

Steel extension stems must be used where the maximum length of the extension exceeds 8 feet and they are to be round or square hot dipped galvanized steel tubing of a solid design with couplings. No pinned coupling is to be used. Extension stem must be complete with operating nut, location ring, and lower socket to fit the operating nut. The configuration of the extension stem nut must match that of the valve it operates.

77-2.02O Rapid Set Concrete

Rapid set concrete for use in thrust blocks must provide fast set and high strength within an hour and comply with section 51-1.02D. Admixtures must comply with ASTM C494 and must not contain calcium chloride.

77-2.02P Fire Hydrants

Wet-barrel fire hydrants must comply with AWWA C503 and these specifications unless specified.

All outlets must be provided with national standard fire-hose threads. Outlets must be equipped with brass or ductile iron caps with chains.

Wet-barrel fire hydrant flanges and appurtenant bury ells and spools must incorporate a six-hole bolt pattern.

No dry barrel fire hydrants are allowed.

77-2.03 CONSTRUCTION

77-2.03A General

Adjust valve cover to grade under section 15-2.10.

Install water meters under section 20-2.12

77-2.03B Apply Painting and Coating

77-2.03B(1) General

Comply with section 59-2.01D.

Prime coating must commence immediately after sandblasting has completed and within the same day. Prime coats, intermediate coats, final coats, and touch up coats must be of the same manufacturer and must be approved by the manufacturer for the intended service. Intermediate and finish coats must be of contrasting colors.

The Engineer will inspect the work before the expiration of the warranty period and defects must be repaired.

Apply coatings under section 59-2, 91, SSPC (Steel Structures Paint Council, Surfaces Preparation Specifications, ANSI A159.1), AWWA C210, C213, C116/A21.16, C550 Standards and Guides.

Finished color of above ground surfaces of pipe risers, elbows, or bends must be OSHA Blue.

Finished color of above ground surfaces of guard posts must be OSHA Yellow (Federal Standard 13591).

77-2.03B(2) Surfaces to Be Coated

Coat all surfaces of materials to be installed as shown except as follows:

Surfaces of grease fittings, valve seats, machined surfaces, shafts, brass and copper tubing, submerged, cement lining and mortar coated pipe, and PVC must be protected and painted.

77-2.03B(3) Surface Preparation

Oil and grease must be removed from aluminum and copper surfaces under SSPC SP-1 using clean cloths and cleaning solvents. For all epoxy coated surfaces, final surface preparation and sandblasting must be to SSPC SP-10. Do not recycle or reuse contaminated blast particles.

Weld spatter and weld slag must be removed from metal surfaces. Rough welds, beads, peaked corners, and sharp edges including erection lugs must be ground smoothly under SSPC.

Welds must be neutralized with a chemical solvent that is compatible with the specified coating materials using clean cloths and chemical solvent.

77-2.03B(4) Application of Coatings

Multiple-component coatings must be prepared using each of the components as specified by the manufacturer. Partial batches are not accepted. Multiple-component coatings mixed beyond their pot life are not acceptable. Small quantity kits for touch-up painting must be provided. Additional components must not be intermixed, even within the same generic type of coating.

Surfaces that are shop primed with zinc rich primers must receive a field touch up of organic zinc primer to cover scratches or abraded areas.

Surfaces that are shop primed with other than organic zinc primer must receive a field touch up with the same primer in the original prime coat.

Coat the exterior of exposed flanges, bolts, and nuts under AWWA C217.

Exterior surfaces of exposed pipe and appurtenances that are not polyethylene tape coated with a mortar over-coat must be field painted.

The exterior surfaces of areas of buried pipes and fittings that are not polyethylene tape coated with a mortar over coat, must be wax tape coated under AWWA C217.

Areas in contact with potable water such as plain ends of pipe, grooved and shouldered ends of pipe and exposed inside surfaces of threaded outlets and blind flanges must be coated with a NSF-accepted material.

77-2.03B(5) Coating and Lining Valves

Coat above ground exterior surfaces of ferrous valves, in vaults or in structures the same as the adjacent piping. Perform the SSPC SP-10 surface preparation and apply the specified prime coat at the place of manufacture. Apply intermediate and finish coats in the field. Finish coat must match the color of the adjacent piping. Coat the exterior of buried metal valves at the place of manufacture per this specification. Minimum total dry film thickness (DFT) must be 15 mils. Coatings must comply with the following:

1. For all above ground exterior coating
 - 1.1. Shop prime coat: Tnemec Series 1, Omnithane applied at 3.5 mils DFT, or Devoe Devthane 231 applied at 4.0 mils DFT, or Amercoat 68HS at 3.5 mils DFT.
 - 1.2. Touch-up (Field): Tnemec Series 1, Omnithane applied at 3.5 mils DFT, or Devoe Devthane 231 applied at 4.0 mils DFT, Amercoat 68HS.
 - 1.3. Intermediate Coat: Tnemec Series V69, Epoxoline II applied at 5.0 mils DFT, or Devoe Bar Devthane 231 applied at 4.0 mils DFT, Amercoat 385 at 6.0 mils DFT.
 - 1.4. Finish Coat: Tnemec Series 1075 Endura-Shield II at 3.0 mils DFT, or Devoe Devthane 379 applied at 4.0 mils DFT, or Amercoat 450 HSG at 3.0 mils DFT.
2. For buried exterior coating
 - 2.1. Shop prime coat: Tnemec Series 1, Omnithane applied at 3.0 mils DFT, or Devoe Bar Devthane 231 applied at 4.0 mils DFT, or Amercoat 385 at 5.0 mils DFT.
 - 2.2. Shop Intermediate Coat: Tnemec Series V69 Epoxoline II applied at 6.0 mils DFT, or Devoe Devthane 231 applied at 6.0 mils DFT, or Amercoat 385 at 6.0 mils DFT.
 - 2.3. Shop Finish Coat: Tnemec Series V69 Epoxoline II applied at 6.0 mils DFT, or Devoe Bar Rust 233 applied at 6.0 mils DFT, or Amercoat 385 at 6.0 mils DFT.
 - 2.4. Interior Lining of valves 4-inches and larger must be coated on their interior metal surfaces except seating areas and bronze and stainless-steel pieces. Sandblast surfaces under SSPC-SP-10.

3. Coat the interior ferrous surfaces as follows:
 - 3.1. Apply powdered thermosetting epoxy per the manufacturer's recommendations to a thickness of 10 to 12 mils or 2 coats of polyamide epoxy to a dry-film thickness of 10 to 12 mils total.
 - 3.2. Epoxy lining must be applied at the factory by the manufacturer, and must meet current volatile organic compound content regulations.
 - 3.3. Epoxy lining for interior surfaces of potable water valves must comply with National Sanitation Foundation, NSF 61 for contact with potable water and must be Tnemec Series 1, Omnithane or Devoe Bar Rust 233 H, or Amercoat Amerlock 2.

77-2.03B(6) Coating, Wrapping, and Lining for Buried Metal

Coat buried metal, which includes pipe, bolts, nuts, structural steel and fittings.

Sandblast to comply with SSPC-SP-6.

Prime Coat must be Tnemec Series 46H-413, Hi-Build Tneme-Tar, or Devoe Devtar 247 applied at 8 to 10 mils DFT, or Amercoat 78 HB.

Finish Coat must be Tnemec Series 46H-413 Hi-Build Tneme-Tar, or Devoe Devtar 247 applied at 8 to 10 mils DFT, or Amercoat 78 HB.

Total dry-film thickness must be 16 to 20 mils.

Wrap buried valves, flanges, fittings, and nuts and bolts per AWWA C-217 and with polyethylene encasement per AWWA C-105.

Nuts and Bolts must be individually wax taped.

77-2.03C Install Water Lines

77-2.03C(1) General

Pipe installation must comply with ASTM C600, C602, C604, and C605.

Lift steel pipe with belt slings and spreader bar, or as recommended by the pipe manufacturer. Lifting pipe with chains is not allowed.

Work includes, butt-straps, welding, flanges, specials, flange insulation kit in vaults, connections to flexible expansion joints.

Bolts and nuts must be lubricated with an authorized anti-seize compound.

Nuts must be tightened in an alternating star pattern to the manufacturer's recommended torque.

Slip-on type flanges intended for field fit-up and welding must be welded inside and outside to comply with AWWA C207.

Installation for welded steel pipe must comply with the AWWA Manual M11, "*Steel Pipe-A Guide for Design and Installation*".

Install all PVC, cement-mortar lined and coated steel, and copper pipe, elbows, short pipe pieces, reducers, tees, crosses, spools, sections with outlets, beveled sections, closure pieces, valves, supports, bolts, nuts, gaskets, jointing materials, and all other appurtenances for water lines.

Do not set pipe on blocks in the trench bottom. If blocking is needed, place sandbags under the pipe. Break sandbags after the haunches are packed.

The tolerance of pipe joints must be plus or minus 1-1/4-inch from the centerline and 1-inch from the elevation shown.

Laying tolerances for the installed pipeline is non-cumulative.

Laying tolerances for the installed pipelines must not vary greater than 1-inch horizontally from the alignment shown. In addition there must be no high or low points occur along the pipeline other than as.

Grade tolerance of the flow line for the water pipeline must not be greater than 1-inch vertically from the elevations shown.

All water pipelines with grades exceed 10 percent must be laid uphill. If water pipelines are laid on a downhill grade, grade must be blocked and held in place until the following pipe section has been installed to provide sufficient support to prevent movement.

Fill the sling removal holes with bedding material. Securely brace the water line length on its alignment and partially backfill the barrel. Keep the space around the joints clear of backfill material on water line with steel joint rings, to allow completion of the joint work. Remove bracing once the water line length is firmly held by its partial backfill.

Unless the sheeting or shoring is to be cut off and left in place, densification of bedding for water lines must be accomplished after the sheeting or shoring has been removed from the bedding zone. Alternate methods of water line bedding, recommended by the water line manufacturer, may be used if authorized.

If water line installation work is not in progress, keep openings and ends of the pipe tightly closed to prevent entrance of animals and foreign materials. Each pipeline end must be closed with an acceptable device at the end of each shift.

Prevent water lines from floating due to water entering the trench from any source. Restore and replace water line to its specified condition and grade if it is displaced due to floating.

For cement-mortar lined and steel pipe, allow for pipe expansion from sunlight and welding by leaving unwelded sections of pipe for lengths of 250 feet during construction.

Labels for water lines must be installed on both potable and recycled facilities exposed to view including above ground appurtenances, meter and blowoff box covers, and where shown.

77-2.03C(2) Install Flanged Joints

Before performing flanged joint connections, clean foreign material off bolts, nuts and flange faces with a power wire brush.

Install the flanged joint with the center of the gasket between the mating flanges.

Coat bolt shafts with waterproof gear grease or primer for wax tape coating before inserting in flange bolt holes. Do not apply grease or primer to threads. Lubricate bolt and nut threads with oil or graphite before installing. Tighten bolts and nuts in a progressive diametrically opposite sequence and torque with a calibrated torque wrench. Apply clamping torque to the nuts.

Coat exposed surfaces, plus nuts and bolts to be buried or made inaccessible with water proof gear grease or primer for wax tape coating. Wrap buried flanges, which connect to valves, with petroleum wax tape under AWWA C217.

Welded steel pipe to be electrically conductive at the valve and flange joints except where an insulating flange assembly is installed.

Install insulating flanges at all locations as shown.

77-2.03C(3) Disinfection Before Connection

Disinfection of water lines must not begin until the appurtenances and the sample ports are installed and authorized. Water used during chlorination must be supplied through a temporary connection with a cross connection control device.

Federal, state and local regulatory agencies must be followed to determine the disposal site of chlorinated water. Before discharging chlorinated water, apply a chlorine reducing agent that comply with AWWA C651, San Diego RWCQB, "Standardized Best Management Practices for Portable Water Discharges in Region 9" and the requirements of this specification.

Installed valves must be disinfected with the same disinfection solution in the waterline.

77-2.03C(4) Connect to Existing Water Line Mains

For connection to existing water line, allow adjustments in alignment by leaving a minimum 10-foot-gap between new water line and existing water line.

Connect to existing waterline as authorized after flushing, pressure testing, and disinfection of the new water lines.

You must perform dry taps. Connecting to an existing water line main requires the presence of the Engineer.

Only the utility owner is allowed to operate existing valves of the existing potable water line.

The new water line must pass pressure testing, disinfection and bacteriological testing before connecting to the existing pipeline.

Connect to existing waterline as follows:

1. Water line at Ramona Blvd can be shut down upon approval for a maximum period of 180 days.
2. The Engineer will select the hours and the date of the shutdown.
3. Connections must be made immediately upon shut down, and work without interruption until the connection is complete.
4. Phase 1 connection must be completed within 8 hours.

77-2.03C(5) Install Butt-Strap Closure

Butt-strap closure joints must be installed as shown under AWWA C206 and the following:

Before butt-strap welding, the pipe and pipe joint must be positioned in the trench using line-up damps such that the abutting pipe sections are not misaligned by more than 1/16 inch.

The pipe ends must be cut straight on joints where butt-straps are used for realignment, adjustment, or deflection, and fillet welds must be made as indicated.

Butt-straps must be field welded to the outside plain end of the pipe along both edges with a full circumferential weld. A minimum of 2 weld passes must be used. The interior of the joints must be filled with a rapid-set mortar and finished off smoothly to match the pipe interior diameter. Clean the butt-strap with a wire brush and apply a cement and water wash coat before applying cement mortar. Galvanized wire mesh, 2 by 4-inch pattern of no. 13 gauge must be installed to the exterior of the joint before applying the mortar coating. Coat the exterior of the closure assemblies with polyethylene tape or heat shrinkable sleeves to cover steel with a minimum of 1.25-inch mortar overcoat.

Seal weld the steel plug to the hand hole after the interior of the joint has been inspected and approved by the Engineer.

Butt-strap closure must provide a 4-inch minimum overlap on each of the adjoining pipe ends and maintain a minimum 2-inch joint gap between pipe ends. Butt weld the longitudinal seams of the butt-strap with full penetration. Weld before completing the circumferential fillet welds. The longitudinal seams of the butt-strap must be offset from the pipe seams by a minimum of 3/4-inch. Do not install butt-straps with angular deflections.

77-2.03C(6) Apply Cement Mortar Lined and Coated Finish Pipe and Fittings

Cement-mortar lined interior joints must comply with AWWA C602.

Use trowel method for finishing interior mortar joints after water line has been installed and backfilled in trenches.

After cleaning the interior joint, pack cement mortar into the joint. Use a steel trowel to obtain a smooth finish. Mortar must be of equal thickness to match the adjoining water line mortar lining.

Where more than a 4-inch joint strip of mortar is required, place galvanized welded wire mesh reinforcement in 2 by 4-inch pattern of No. 13 gauge over the exposed steel. Install the mesh so that the wires on the 2-inch spacing, direction run circumferentially around the pipe. Crimp the wires on the 4-inch spacing to support the mesh 3/8-inch from the metal surface. Steel-trowel finish the interior mortar to match adjoining mortar-lined pipe sections.

77-2.03C(7) Install Wax Tape

The exterior surfaces of areas of buried pipes and fittings that are not polyethylene tape coated with a mortar over coat, such as flanges, grooved ends, or plain ends for butt-straps, must be wax tape coated under AWWA C217. Areas in contact with potable water such plain ends of pipe, grooved and shouldered ends of pipe and exposed inside surfaces of threaded outlets and blind flanges must be coated with a NSF-accepted material.

77-2.03C(8) Construct Thrust Blocks

Place concrete against undisturbed earth. The undisturbed earth must be a plane surface at right angles to the force to be resisted. During placement of concrete, prevent water line floating by temporary braces or internal weighting the water line.

Place blocks so joints of water line and fittings will be accessible for repair.

Thrust blocks must be located at unrestrained water line fittings and must bear against firm, undisturbed soil.

The thrust blocks must be centered on the fitting so that the bearing area is opposite the direction of the thrust.

Thrust block concrete must not hinder maintenance access to the valve. Before filling the water line, concrete thrust blocks must cure for a minimum of 72 hours.

Construct thrust blocks under section 90-2 except: use rapid set cement to achieve high strength within an hour. Use 520 pounds of rapid set cement per cubic yard of mix and combine with the sand and aggregate for Class A concrete per SSPWC, Section 201.

77-2.03D Install Valves

77-2.03D(1) General

Valves must be installed under the manufacturer's recommendations. Furnish and install valve box for gate valve, butterfly valve, plug valve, and at other locations as shown. Do not place the box bear directly on the valve gearing.

Plug valves must be hydrostatically shell pressure tested at twice the CWP rating. Each valve seat must be tested at 150 percent CWP pressure.

Install valves with the bolt holes straddling the vertical and horizontal centerlines of pipe, with the operating nut in the vertical position. Valves must be set in true alignment straddling the centerline of pipe with the valve operator in the vertical position. Valves must be installed under the manufacturer's recommendations and these specifications.

The operating nut must have a valve stem extension and an 8 inch PVC pipe gate well. The valve stem extension and gate well must be installed in a level position with the gate well centered over the valve stem. The valve stem or plug valve must be installed in a level position with the nut offset the pipe and valve centered over the nut.

Adjust the valve box frame over the extension pipe to finished grade. A concrete ring around the valve box frame is required as shown and flush with the pavement finished surface.

Paint the valve box cover with two coats of paint.

77-2.03D(2) Combination Air Release and Air/Vacuum Valves

Assemblies must be installed above ground. Set upper portion of riser to at least 3-inches above final grade.

Assemblies installed must have an isolation valve to allow future maintenance. Isolation valves installed above ground must have the capability to be locked out. Isolation valves installed below ground must have a debris cap with a locking device.

Place concrete slab under section 73. Install valve and valve enclosure.

77-2.03E Install Blow-off Assembly

Backfill blow-off risers with crushed rock. Set meter box and lid to final grade.

77-2.03F Abandon Water Lines

Once the utility owner has isolated the water system, you will disconnect existing piping and perform piping modifications as shown. Once the existing system is isolated, you will remove and abandon the existing pipe.

Cut existing water line to be abandoned and cap at low end of pipeline. At high point of pipeline, fill pipeline completely with a lean, flowable, concrete mix design.

77-2.03G Abandon Water Valves

Remove existing water valves, fire hydrants and blow-off assemblies under section 15-2.02L.

77-2.03H Adjust to Grade Fire Hydrant

Provide all equipment and materials to adjust to grade a fire hydrant.

Uninstall existing fire hydrant from break-off riser.

Uninstall break-off riser and steel pipe spool, replace with new appropriate size steel pipe spool and new break-off riser to set fire hydrant to the proposed elevation.

Install fire hydrant on top of new break off riser.

77-2.03I Adjust to Grade Water Meter

Provide all equipment and materials to adjust to grade a water meter.

Uninstall existing water meter from copper pipe.

Extend copper pipe to finished grade.

Install existing meter to finished grade.

77-2.04 PAYMENT

Not Used

77-3 SEWER**77-3.01 GENERAL**

Section 77-3 includes general specifications for constructing sanitary sewer facilities.

Existing services are to remain operational until the engineer determines they are no longer needed.

77-3.01A Submittals**77-3.01A(1) General**

For PVC sewer pipe and fittings, submit before shipping:

1. Certificate of compliance
2. Typical joint details
3. Calculations supporting wall thickness

For precast sewer manholes, submit before fabrication:

1. Certificate of compliance
2. Concrete mix design
3. Dimensions
4. Typical frame and cover details
5. Aggregate base below manhole base
6. PVC liner material specifications and details
7. Letter of Certification for the liquid antibacterial additive

77-3.01A(2) Protection of Existing Sewer

The sewer is a critical facility and must be maintained and protected during construction. Mark and identify the locations of the existing sewer. At no time are construction loadings greater than HS-20, nor greater than 4 feet of soil cover allowed over the existing sewer within 45 degrees of the existing sewer. If loads greater than this are required, submit 14 days in advance a sewer protection plan, signed by an engineer registered as a Civil Engineer in the State. The sewer protection plan must include structural engineering plans and calculations detailing the means and methods to protect the existing sewer.

77-3.01A(3) Sewage Spill Response

You are fully responsible for sewage handling and preventing a sewage spill, containing a sewage spill, recovery and legal disposal of spilled sewage, fines, penalties, claims and liability arising from negligently causing a sewage spill, and violation of law, ordinance, code, order, or regulation because of the spill. Call the Rainbow Municipal Water District's Engineer notification number at (760) 728-1178 and act immediately to control a sewage spill. Take appropriate steps to contain it according to the sewage spill response plan and flow diversion plan. Immediately notify the Engineer, Rainbow Municipal Water District, City of Fallbrook, City of Bonsall, and County of San Diego representatives and report project name, location, Contractor name, Project Engineer and Resident Engineer's names.

The Engineer may institute further corrective actions to fully comply with existing laws, ordinances, codes, orders or other pertinent regulations. You are responsible for costs incurred for the corrective action including mitigation measures or habitat restoration, and obtaining after-the-fact permits if necessary in environmentally sensitive areas. These permits include those from the City of Fallbrook, City of Bonsall, California Coastal Commission, U. S. Army Corps of Engineers, the California Department of Fish and Game, and relevant agencies.

You must have the bypassing equipment available and on-site during all construction activities including grading.

In case of a sewage spill, immediately call the 24 hours emergency notification number stated above and act immediately to control the spill. Take appropriate steps to contain it per the Sewage Spill Response and Prevention Plan.

Immediately notify the Engineer and report the project name, your name and title, time of spill, location of spill, contractor name, Project Engineer and Resident Engineer names. Provide photographs of the spill and the clean-up efforts and results.

Within 3 business days from spill occurrence, submit a written report to the Engineer describing the following information:

1. Location of the spill
2. Nature and estimated volume
3. Date and time
4. Duration
5. The cause
6. Type of remedial and/or clean up measures taken (including erosion control measures)
7. Date and time of implementation
8. Corrective and/or preventive actions taken to avoid further spills
9. Equipment used in spill response
10. Environmentally sensitive habitat
11. Results of necessary monitoring
12. A list of who was notified at the City, date and time of notification, date and time you were notified of the spill, date and time you arrived on job site.

You are responsible for preventing sewage spill, containing a sewage spill, recovery and legal disposal of a spilled sewage, fines, penalties, claims and liability from a sewage spill, and violation of law, ordinance, code, order, or regulation as a result of the spill.

77-3.01A(4) Proposed Sewer Flow Diversion Plan

This section contains the proposed construction sequence and bypass plan for installing the new sewer line and the expected minimum by-passing requirements. You must ensure that the existing sewer system including the sewer line, related manholes, and lateral service connections remain functional until this flow can be either temporarily diverted via by-passing or placed into the newly constructed sewer system. You may also provide written notification to the residence for an 8 hour maximum planned outage. The Engineer will prepare the notices, and you will print and hand deliver to each residence for the planned outage at 7 days before, 48 hours before, and 24 hours before the scheduled service disruption.

You must engineer and perform your own by-passing pumping operations as required to support your means and methods.

If bypass plan is different than specified in section 77-3.03B, submit a bypass plan which includes at least the following:

1. Conform to the bypassing sequence contained in these specifications or modified and approved to complete the work as specified.
2. The diversion plan must indicate the sequence of diversion operations to maintain wastewater service during construction and complies with the provisions of these specifications.
3. The bypassing plan must include the highline, bypass pumping, and temporary below ground gravity flow piping.
4. Submit your bypass monitoring program. Include frequency for continuously monitoring flow levels downstream and upstream of the flow diversion to detect any failure.
5. A sewage spill prevention and response plan
6. Submit maintenance procedures and schedule and monitoring log. The operation procedure should include the cleaning out of the primary pumps impellers of any debris caught up in them, as needed.
7. You must also provide drawings showing the location of bypass pumping equipment for each line segment of the bypassed along with the specification of pumping equipment, type, size, capacity and amount of pumps required to handle the peak wet weather flow.

Allow at least 30 days for review and approval before commencing work. Submit your monitoring procedure and frequency for monitoring the flow levels downstream and upstream of the flow diversion to detect possible failures . Maintain a log of the monitoring and submit daily.

Inspect and maintain the diversion system daily, or more often if required, including the back-up system. Submit maintenance procedures and frequency with your bypass plan. Maintain a log of inspection, maintenance and repair records and submit.

Size the flow diversion system to handle the peak flow and include a 100 percent backup in the flow diversion system for wet weather flows.

Use new high density polyethylene 3608 DR 17 pipeline material for by-pass. Provide lower DR if pressure requirements require it. Following the completion of sewer flow diversion plans clean pipes, transport and remove piping.

If the diversion system requires pumping, each pump, including the backup pumps, must be a complete unit with its own suction and discharge piping. Operate the backup flow diversion system for a minimum of 25 percent of the total diversion time on a weekly basis. The backup flow diversion system must be fully installed, operational, and ready for use. Hydraulically test the diversion system with clean water before wastewater flow diversion. Both the primary and backup flow diversion systems are fully functional and adequate, and certify.

Provide a temporary wastewater storage tank adjacent to a new by-pass and provide a minimum of 24-hours tank capacity. Provide visual and audio and remote telemetry high monitor logs of wastewater levels. Stand-by sewage pumper truck is required on-site during sewage pump switchovers.

Provide one fuel tank for pump, if fuel-generator pumps are used. Provide an emergency standby power generator if electric power driven pump is used. Provide a fuel level indicator outside of the fuel tank. Continuously monitor the fuel and ensure that the fuel level does not drop below a two hours usage. Protect the fuel supply from contamination and leaks.

77-3.01A(5) Sewage Spill Prevention

Submit a sewer spill prevention and response plan. The plan must follow the "*Zero Spill*" policy and must include the following:

1. Identifying nearby environmentally sensitive area such as waterway, channel, catch basin and entrance to existing underground storm drain.
2. Making arrangements for an emergency response unit, stationed at or near the job site, comprised of emergency response equipment and trained personnel to be immediately dispatched in the event of a sewage spill. This could also include field biologist and/or archaeologist if in an environmentally sensitive area such as a canyon.
3. Developing an emergency notification procedure, that includes an emergency response team with telephone numbers and arrangements for backup personnel and equipment. The emergency response unit must be able to dispatch to the job site 24 hours a day, 7 days a week. Designate primary and secondary representatives, their respective phone numbers, pager numbers, and mobile phone numbers. These representatives must be accessible and available at times to respond immediately to a sewer spill event.
4. Identifying property owners who are affected.

It is your responsibility to assure that field forces, including subcontractors, know and obey safety and emergency procedures in these specifications.

77-1.01A(6) PVC Certification

During production of the pipe, the manufacturer must perform the specified tests for each pipe marking. A certification by the manufacturer indicating compliance with specification requirements must be delivered with the pipe. The certification must include the test result data. Pipe, which is not installed within 120 days of latest test, must not be used without authorization.

77-1.01A(7) Concrete Mix Design Antimicrobial Certification

The liquid antibacterial additive must be an EPA registered material and the registration number must be submitted.

A letter of certification must be submitted stating that the correct amount and correct mixing procedure was followed based on manufacturers' recommendations.

77-3.01B Quality Control and Assurance

77-3.01B(1) General

Before testing, pipes must be thoroughly cleaned from manhole to manhole with a sewer scrubbing ball. Debris and trash must be removed from each manhole.

77-3.01B(2) Tolerances

Laying tolerances for the installed pipeline is non-cumulative. Laying tolerances for the installed pipelines must not vary greater than 1-inch horizontally from the alignment as shown. The lay of the pipe must be such that no high or low points occur along the pipeline other than as shown.

Grade tolerance of the flow line of the sewer pipeline must be as follows:

1. 1/4-inch for 4-inch and smaller for each 50-foot of pipeline.
2. The lesser of 3/4-inch for 6-inch to 24-inch pipeline for each 100-foot of pipeline, or a total grade tolerance of 0.05 feet between manholes.
3. Before performing the CCTV, the Contractor must introduce enough water into the pipeline to fill all low sections and flow through the downstream manhole. A 3/4-inch target must be used. Water must not pond anywhere within the pipeline greater than 3/4 -inch in depth when tested with wet CCTV, with an inclinometer survey, and as measured with a laser profiler on the CCTV camera. Any areas of pipeline sag as indicated by the test greater than 3/4-inch must be corrected.

All sewer pipelines must be laid uphill.

For the sewer line, perform the CCTV inspection wet to check for ponding water within the alignment. Any sewer line with water ponding over 3/4-inch between manholes must be corrected back to the proper line and grade.

77-3.01B(3) Sewer Leakage and Infiltration Testing

77-3.01B(3)(i) General

Each section of sewer pipe between 2 successive manholes must be tested for leakage. The sewer laterals to the property line must be included in the test.

An infiltration test must be made where groundwater is encountered.

77-3.01B(3)(ii) Air Pressure Test

PVC pipe must be air pressure tested under the test procedures outlined in SSPWC Section 306-1.4.4, Amendment 306-1.4.4.1, and the *Low Pressure Air Test for Sanitary Sewers* as published by the National Test after the line and appurtenances are installed, and backfilled.

The test section must be pressurized to 4.0 psi and held above 4.0 psi for no less than 5 minutes. If groundwater is above the pipe, increase the air pressure to 0.43 psi for each foot the water table is above the invert of the pipe. After air supply is securely turned off or disconnected, there must be a two minute waiting period to allow the stabilization of air within the sewer line before beginning the actual test. Air may be added only to maintain a pressure of 4.0 psi. Start timing once the internal pressure decreases to 3.5 psi. Count the seconds until the pressure has decreased to 2.5 psi.

The minimum permissible pressure holding times for the sewer main, must comply with National Clay Pipe Institute Air Test Tables "*Low Pressure Air Test for Sanitary Sewers (Procedures and Tables)*".

The maximum length that may be tested at a time is 500 feet, or the length between any two adjacent manholes. Test each section of pipe between manholes, including the manholes. Ensure the plug is properly installed.

Once the air test is completed, release the air slowly through the valve incorporated into the test equipment. Remove air test plugs after air pressure is no longer measurable.

77-3.01B(3)(iii) Infiltration Test

Before testing for infiltration, the ends of the sewer pipe section to be tested must be cleaned using a Wayne Ball. Pipe must be capped or plugged to prevent the entrance of water, and pumping of groundwater must be discontinued for at least 3 days.

Infiltration discovered before completion and acceptance of the sewer must be corrected. The sewer must be examined and the source of infiltration eliminated. Following repairs or replacement as necessary, including backfill and compaction, the subject line must be retested to assure no infiltration.

An air leakage rate is less than the maximum allowed, the television inspection is satisfactory, and the water infiltration rate is zero.

77-3.01B(4) Alignment, Grade and Deflection Test

Grade and alignment must comply with SSPWC) Section 306-1.2.2 and 306-1.2.12 and the requirements of these specifications.

Perform deflection tests 30 days or more after backfill is placed and compacted. Inspect the pipe for offsets and clear obstructions before testing.

Mandrel for field testing must be a rigid, nonadjustable, odd-numbering-leg (nine legs minimum) mandrel having an effective length not less than shown 306-1.2.12.

77-3.01B(5) Manhole Lining Test

77-3.01B(5)(i) General

Spark test cured manhole lining for pinholes under SSPWC Section 500-2.4.2. Pinhole repair must comply with SSPWC Section 500-2.4.5.

Lined manholes must have field-welded joints pull tested and the liner must be holiday tested.

The pull test must comply with ASTM D7234.

The holiday tester is set at a minimum of 100 volts per mil of applied film thickness but may be adjusted as necessary to detect the holiday created for the test per NACE International SPO 188-2006. All holidays discovered will be marked for repair. Field welds must withstand a pull test of at least 100 pounds per liner inch, applied perpendicularly to the concrete surface for a period of one minute, without evidence of cracks or separations. This test must be conducted at a temperature of 70 to 80 degrees F.

PVC-Lined and polyurethane-coated surfaces must be holiday tested with an electrical holiday detector by Tinker and Rasor, Model # AP-W with power pack, with the instrument set at 20,000 volts. Imperfections identified on the PVC lining and polyurethane coating must be repaired with materials-in-kind and the test must be repeated until no holidays are evident.

77-3.01B(5)(ii) Vacuum Testing of Manholes

Vacuum test of manholes must comply with ASTM C1244.

Manholes must be tested after assembly and before mortaring the joints or backfilling. In the case of manholes incorporating a PVC liner and polyurethane coating, the testing is to take place before mortaring the joints, welding the liner seams between sections, applying the coating, or backfilling. Lift holes must be plugged with an approved grout before testing. Pipes entering the manhole must be plugged, and bracing installed. The test head must be placed inside the top of the cone section and the seal inflated under the manufacturer's recommendations.

A vacuum of 10-inches of mercury must be drawn. The time must be measured for the vacuum to drop to 9-inches of mercury. The manhole will pass the test if the time for the drop is greater than 60 seconds.

If the manhole fails the test, necessary repairs must be made and the test repeated until passed.

77-3.01B(6) Controlled Low Strength Material Testing

Controlled low strength material, CLSM, must comply with ASTM D4832, the material must have a 28-day compressive strength from 50 to 100 psi.

77-3.01B(7) Mandrel Test

Following the completion of the above testings, the placement of backfill, and the installation of all utilities, but prior to permanent paving, all PVC sewer pipe must be cleaned and then mandrelled that comply with SSPWC, Section 306-1.2.12. A rigid mandrel, with a circular cross section having a diameter of at least 95% of the specified inside diameter, must be pulled through the pipe by hand. The minimum length of the circular portion of the mandrel must be equal to the nominal diameter of the pipe.

Obstructions encountered by the mandrel must be corrected and retested until passing.

77-3.02 MATERIALS

77-3.02A General

For materials not specified on the "*Approved Materials List, Rainbow Municipal Water District*" in the Information Handout, requirements are specified in section 77.

Additional requirements for materials on the "*Approved Materials List, Rainbow Municipal Water District*" in the Information Handout, may be described in section 77.

Piping and accessories for sewer manholes must match the sewer line material and be listed on the Approved Materials List.

Piping and accessories for sewer clean-outs must match the sewer line.

Joint sealant must be used to form a continuous watertight seal on the concrete base and between successive precast concrete manhole. Joint sealing compound must be a mastic-type material in a flexible rope or rolled form with removable wrapper sized to fit into the key of manhole sections.

Damp-proofing material must consist of 2 coats of a single-component self-priming, heavy-duty cold-applied coal tar.

All exposed interior surfaces of the manhole must be lined.

PVC liner for manhole must comply with SSPWC Section 210-2, ASTM 1735 and ASTM 1698. Manholes must be PVC-lined in the precast shaft sections, cone sections and grade rings must have an integrally cast PVC T-shaped liner of 0.065-inch minimum thickness.

77-3.02B Bedding

77-3.02B(1) General

Pipe bedding and pipe zone backfill for the Sewer pipeline and manholes must comply with section 19-3.02F and 19-3.03I except pipe bedding must be paced over the full width of the trench.

77-3.02B(2) Pipe Bedding and Pipe Zone Backfill For Sewer Lines

3/4-inch rock must be used for pipeline bedding and pipe zone of sewer lines. Pipe bedding must begin a minimum of 12-inches below the bottom of the pipe. The pipe bedding must be placed over the full width of the trench to 12-inches above the top of the pipe outside diameter.

77-3.02B(3) Bedding for Manhole Bases

Crushed rock must be used underneath the manhole bases and compacted to a relative density of 90 percent. The thickness of the bedding must be a minimum of 12-inches. The bedding must be placed over the full width of the trench.

Crushed rock material for manhole bases must have the following gradations:

Sieve Size	3/4-Inch Max Crushed Rock % Passing
1-inch	100
3/4-inch	90-100
1/2-inch	55-90
3/8-inch	20-55
No. 4	0-10

77-3.02C Polyvinyl Chloride Gravity Sewer Pipe and Fittings

PVC pipes and fittings must comply with AWWA Manual M-23, "PVC Pipe Design and Installation", ASTM C900 and as follows:

PVC gravity sewer line and fittings must be made of PVC plastic having a cell classification of 12454-B, 13364-A, or 13364-B as defined in ASTM D1784. PVC gravity sewer line, fittings, joints, 4-inch through 15-inch, must be manufactured under ASTM D3034, SDR 35 and must have gasketed joints. PVC gravity sewer pipe, fittings, joints, 18-inch through 24-inch, must be manufactured under the requirements of ASTM F679 with T-1 wall thickness and must have gasketed joints. Pipe must be of solid wall construction with smooth interior and exterior surfaces.

The minimum pipe stiffness for PVC pipe must be 46 psi according to ASTM D2412.

Pipe must be jointed with integral bell gasketed joint and comply with ASTM D3212. The gasket must be manufactured from a synthetic elastomer and factory installed in the belled end of the pipe. Gasket must comply with ASTM F477.

Pipe must have a home mark on the spigot end to indicate proper penetration when the joint is made. The socket and spigot configurations for fittings must be compatible to the pipe.

77-3.02D Precast Concrete Manhole

Precast concrete manhole and components must comply with ASTM C478 and as shown.

The antimicrobial agent, Con^{MIC} Shielded[®], BioConcrete[™], ConBlock MIC or equal, must be used to render the concrete uninhabitable for bacteria growth for all concrete work of the precast manhole and cast-in-place manhole bases per manufacture's recommendations. The liquid antibacterial additive must be an EPA registered material and the registration number must be submitted for approval prior to use in the project. This amount must be included in the total water content of the concrete mix design. The additive must be added into the concrete mix water to insure even distribution of the additive throughout the concrete mixture.

Manhole bases must be cast-in-place with a formed recess shaped to match the first precast shaft section. The manhole base must extend 12 inches below the bottom of the lowest pipe and 6 inches above the top of the largest pipe. Manhole bases for pipes 18 inches or larger must incorporate a 4 inches wide grating-support ledge, cast integrally with the drain channels, at the top of the base.

Manhole shafts must be as follows:

1. Shafts must be fabricated from precast shaft sections, eccentric cone sections and grade rings that comply with ASTM C478-95a.
2. Total circumferential reinforcement steel area must be at least 0.0025 times the inside diameter in inches.
3. Steel cage must be placed in the center third of manhole wall thickness.
4. Concrete compressive strength must be 4500 psi at 28 days.
5. Steel reinforcing yield strength must be 60,000 psi that comply with ASTM A615.

Precast shaft sections, cone sections and grade rings on PVC-lined manholes must have an integrally cast PVC T-shaped liner of 0.065-inch minimum thickness. A 100% solids elastomeric polyurethane coating must be applied to exposed concrete at the interior of cast-in-place bases.

77-3.02E Manhole Frame and Covers

Manhole frames must be 35-1/2 inches in diameter with two concentric covers, made of cast-iron and comply with ASTM A 48, Class 30, and as shown. Locking frames and covers are required.

Frames and covers must comply with section 86-2.06A for wheel loading.

Covers must have the words "*RMWD*" and "*SEWER*" cast into the cover. No other lettering is allowed on the top of the cover.

Castings must be smooth, clean, and free from blisters, blowholes and shrinkage. Mating surfaces of the frame and cover must be machined to prevent movement of the lid. Frames and covers must be match marked in sets before shipping.

Castings must be dipped twice in asphalt or coal tar and oil applied at a temperature between 290 and 311 degree Fahrenheit.

77-3.02F Mortar

Cement for mortar must comply with ASTM C150 Type V. Aggregate for mortar must comply with ASTM C33 including ASTM C289.

Repair mortar must be a two-component, cement-based material specifically designed for structurally repairing damaged concrete surfaces and comply with ASTM C928. Mortar and an epoxy bonding agent must be used to repair minor surface damage to precast sections or cast in place manhole bases.

The epoxy bonding agent must comply with ASTM C881 and be an epoxy-resin-based material intended for bonding new mortar to hardened concrete.

The repair mortar must exhibit the properties of high compressive and bond strengths and low shrinkage. A medium-slump repair mortar must be used on horizontal surfaces, and a non-sag, low-slump repair mortar must be used on vertical or overhead surfaces.

77-3.02G Manhole Liner

77-3.02G(1) General

All exposed interior surfaces of the manhole must be lined as shown.

77-3.02G(2) PVC Liner

PVC liner for manhole must comply with SSPWC section 210-2, ASTM 1735 and ASTM 1698. Manholes must be PVC-lined. Precast shaft sections, cone sections and grade rings must have an integrally cast PVC T-shaped liner of 0.065-inch minimum thickness.

77-3.02G(3) Polyurethane And Epoxy Protective Lining System

A 100 percent solids elastomeric polyurethane coating must be applied to exposed concrete at the interior of precast and cast-in-place bases to cover all areas not covered by the PVC liner. This coating must be applied the full height of all existing modified manholes and bases.

Lining system must comply with SSPWC section 500-2.7. Coating must be cream colored.

The manhole base must be primed with epoxy and lined with a 125-mil dry film thickness of 100 percent solids elastomeric polyurethane with a minimum Shore D hardness of 55.

Furnish a minimum of 2 plugs per manhole for applied thickness verification.

77-3.02H Manhole Pipe Connector

Pipe penetrations for sewer applications must use a watertight flexible pipe connector or ring-type seal. Precast manholes must utilize an integrally cast embedded pipe connector installed in a circular block out opening under ASTM C 923.

Connections to existing manholes must use a boot type connector under ASTM C923 installed in a cored opening.

Cast-in-place bases must incorporate a ring-type seal on the pipe to be embedded in the concrete.

77-3.03 CONSTRUCTION

77-3.03A General

Unload the pipe using a crane, backhoe, or rope and skids, per manufacture's recommendation. If using skids, pipes must be prevented from striking other pipe.

Adjust sewer manholes under section 15-2.10B.

Abandon sewer manholes under section 15-2.07D and SSPWC section 306-5.

77-3.03B Sewer Bypassing

77-3.03B(1) General

The following is the expected sewer bypass sequencing required to perform the work.

77-3.03B(2) Sewer Bypassing, Phase 1

Sheets SS-1 to SS-2 show requirements to connect to existing sewer upstream of new SSMH MH-1 to existing SSMH M-3-52 at Sweetgrass Lane:

- 1 Construct SSMH-1 over existing sewer line.
- 2 Construct sewer line and manholes from SSMH-1 to SSMH-7. Test newly constructed pipeline and manholes.
- 3 Modify SSMH M-3-52 and construct sewer line from SSMH-5 to the modified manhole SSMH M-3-52.
- 4 Place new sewer line into service and plug downstream existing sewer line from modified SSMH M-3-52 to divert the flow to SSMH-7.
- 5 Construct new sewer lateral to connect existing lateral to new sewer line near Station 34+76. This existing manhole is to be abandoned and new sewer lateral connection, which passes through the existing manhole, must allow for abandonment of this manhole.
- 6 Plug upstream existing sewer line to be abandoned at SSMH-1.
- 7 Abandon existing sewer line and existing manholes between the modified existing SSMH M-3-52 and new SSMH-1.

77-3.03B(3) Sewer Bypassing, Phase 2

Sheets SS-2 to SS-3 show requirements to connect to existing sewer upstream of new SSMH-7 at Sweetgrass Lane to existing SSMH MH-9 south of Ramona Road:

- 1 Place overland temporary bypass, consisting of overland temporary pipe and pumps, to divert flow from existing manhole L-3-03 to new SSMH-7.
- 2 Bypass sewer lateral near station 41+35 to go around the existing sewer line to be demolished.
- 3 Plug downstream sewer from manhole SSMH L-3-03. Plug upstream from SSMH M-3-52.

- 4 Construct sewer main through existing sewer line. Demolish existing sewer line and existing manholes from SSMH-7 to SSMH-9, test and place into service.
- 5 Extend new sewer lateral from existing lateral to new sewer line near Station 41+35. Remove sewer lateral bypass when connection is complete.
- 6 Place temporary flow through 12-inch PVC pipeline by-pass from existing manhole L-3-03 to SSMH - 9. Pipeline must be laid at invert of existing sewer line in L-3-03 to invert of new manhole at SSMH MH-9.
- 7 Remove temporary overland bypass pipeline and pumps.

77-3.03B(4) Sewer Bypassing, Phase 3

Sheets SS-3 show requirements to connect to existing sewer upstream of new SSMH -9 new sewer SSMH 14 North of Ramona Road:

- 1 Construct sewer main and manholes from SSMH-9 to SSMH-13. Construct sewer line from SSMH-12 to existing SSMH L-3-05 and modify existing SSMH L-3-05 at Ramona Road. Test and place into service.
- 2 Plug downstream existing sewer at SSMH L-3-05.
- 3 Build new lateral near station 49+75 and connect to the new sewer line. This existing manhole is to be abandoned and new sewer lateral connection must allow for abandonment of this manhole.
- 4 Plug upstream sewer line at existing SSMH L-3-03.
- 5 Remove Phase 2 temporary flow through bypass.
- 6 Abandon in-place existing sewer line and existing manholes from existing SSMH L-3-03 to modified manhole SSMH L-3-05.
- 7 Place temporary overland by-pass from existing sewer manhole SSMH L-3-48 to new sewer manhole SSMH-13.
- 8 Plug downstream sewer manhole at SSMH L-3-48 and upstream existing sewer manhole at SSMH L-3-05.
- 9 Construct sewer main through existing sewer line. Demolish existing sewer line and existing manholes from SSMH-13 to SSMH-14, test, and place into service.
- 10 Place temporary flow through 12-inch PVC pipeline by-pass from existing manhole L-3-48 to SSMH - 14. Pipeline must be laid at invert of existing sewer line in L-3-48 to invert of new manhole at SSMH MH-14.
- 11 Remove temporary overland bypass pipeline and pumps.

77-3.03B(5) Sewer Bypassing, Phase 4

Sheets SS-3 to SS-5 show requirements to connect to existing sewer upstream of the new SSMH-14 to the existing SSMH 19:

- 1 Construct new sewer from new sewer manhole SSMH-14 and construct new sewer manhole SSMH-18. Test, and place into service.
- 2 Bypass sewer laterals near Stations 59+20, 66+60 and 68+40 to go around the existing sewer line to be demolished. Construct sewer lateral to extend from existing lateral to new sewer line near Stations 59+20, 66+60 and 68+40. Remove sewer lateral bypass when connection is complete.
- 3 Place overland temporary by-pass from existing manhole SSMH L-3-46 to SSMH -18 and plug downstream sewer from manhole SSMH L-3-46. Provide access at all times around or over temporary by-pass to private drive 2818 Highway 76.
- 4 Plug upstream sewer line at existing SSMH L-3-46.
- 5 Remove Phase 3 temporary flow through bypass.
- 6 Construct new sewer main through existing sewer line. Demolish existing sewer line and existing manholes from SSMH-18 to SSMH-19, test, and place into service.
- 7 Place temporary flow through 12-inch PVC pipeline by-pass from existing manhole L-3-46 to SSMH - 19. Pipeline must be laid at invert of existing sewer line in L-3-46 to invert of new manhole at SSMH MH-19.
- 8 Remove temporary overland bypass pipeline and pumps.

77-3.03B(6) Sewer Bypassing, Phase 5

Sheets SS-5 to SS-6 show requirements to connect to existing sewer upstream of new SSMH-19 to SSMH-23:

- 1 Construct sewer line and sewer manholes from SSMH-19 to SSMH-21. Test, and place into service.
- 2 Bypass sewer laterals near Stations 70+10 and 76+80 to go around the existing sewer line to be demolished. Construct new sewer lateral to extend from existing lateral to new sewer line near Stations 70+10 and 76+80. Remove sewer lateral bypass when connection is complete.
- 3 Place temporary overland by-pass from existing manhole SSMH L-4-04 to SSMH -21.
- 4 Remove Phase 4 flow through bypass.
- 5 Plug downstream sewer from manhole SSMH L-4-04 and upstream SSMH L-3-46.
- 6 Construct new sewer main through existing sewer line. Demolish existing sewer line and existing manholes from new sewer manhole SSMH-21 and construct new sewer manhole SSMH-23. Test, and place into service.
- 7 Place temporary flow through 12-inch PVC pipeline bypass from existing manhole L-4-04 to SSMH -23. Pipeline must be laid at invert of temporary manhole over existing sewer line to invert of new manhole at SSMH MH-23.
- 8 Remove temporary overland bypass pipeline and pumps.

77-3.03B(7) Sewer Bypassing, Phase 6

Sheets SS-6 and SS-7 show requirements to connect to existing sewer upstream of new sewer manhole SSMH-23 to SSMH -25:

- 1 Construct sewer line and sewer manholes from SSMH-23 to SSMH-24. Test, and place into service.
- 2 Bypass sewer laterals near Stations 82+50 to go around the existing sewer line to be demolished. Construct new sewer lateral to extend from existing lateral to new sewer line near Stations 82+50. Remove sewer lateral bypass when connection is complete.
- 3 Place temporary overland bypass from existing manhole SSMH L-4-10 to SSMH -24 and plug downstream sewer from manhole SSMH L-4-10.
- 4 Plug upstream sewer line at SSMH L-4-04.
- 5 Remove Phase 5 temporary flow through bypass.
- 6 Construct new sewer main through existing sewer line. Demolish existing sewer line and existing manholes from new sewer manhole SSMH-24 and construct new sewer manhole SSMH-25. Test, and place into service.
- 7 Place temporary flow through 12-inch PVC pipeline by-pass existing manhole L-4-10 to SSMH -25. Pipeline must be laid at invert of temporary manhole over existing sewer line to invert of new manhole at SSMH MH-25.
- 8 Remove temporary overland bypass pipeline and pumps.

77-3.03B(8) Sewer Bypassing, Phase 7

Sheets SS-7 and SS-8 show requirements to connect to existing sewer upstream of from new sewer manhole SSMH -25 to SSMH -30:

- 1 Construct sewer line and sewer manholes from SSMH-25 to SSMH-29. Test, and place into service.
- 2 Bypass sewer laterals near Stations 90+05 and 94+10 to go around the existing sewer line to be demolished. Construct new sewer lateral to connect existing lateral to new sewer line near Stations 90+05 and 94+10. Remove sewer lateral bypass when connection is complete.
- 3 Modify existing sewer manhole SSMH L-4-07 and construct sewer line from existing SSMH L-4-07 to SSMH-29. Test and place into service.
- 4 Plug downstream sewer at SSMH L-4-07 and upstream sewer at temporary manhole from Phase 6.
- 5 Remove Phase 6 temporary flow through by-pass.
- 6 Place temporary overland pipeline bypass from temporary manhole over existing sewer line near SSMH-30 to new SSMH-29. Plug downstream sewer from temporary manhole.
- 7 Construct new sewer main through existing sewer line. Demolish existing sewer line and existing manholes from L-4-10 to temporary manhole adjacent to SSMH-30 from new sewer manhole SSMH-29 and construct new sewer manhole SSMH-30. Test, and place into service.

- 8 Place temporary flow through 12-inch PVC pipeline bypass from temporary manhole over existing sewer line to SSMH -30. Pipeline must be laid at invert of temporary manhole over existing sewer line to invert of new manhole at SSMH MH-30.
- 9 Remove temporary overland bypass pipeline and pumps.

77-3.03B(9) Sewer Bypassing, Phase 8

Sheets SS-8 and SS-9 show requirements to connect to existing sewer upstream of new sewer manhole SSMH-30 to SSMH-37:

- 1 Construct sewer line and sewer manholes from SSMH-30 to SSMH-36. Test, and place into service.
- 2 Construct sewer line lateral and associated manholes at Limber Pine Road and connect to new sewer line. Test and place into service.
- 3 Place temporary overland pipeline bypass from existing manhole K-4-54 to new SSMH-36. Plug downstream sewer from K-4-54.
- 4 Remove Phase 7 flow through temporary bypass.
- 5 Construct new sewer main through existing sewer line. Demolish existing sewer line at temporary manhole near SSMH-30 to existing SSMH K-4-54 from new sewer manhole SSMH-36 and construct new sewer manhole SSMH-37. Test, and place into service.
- 6 Place temporary flow through 12-inch PVC pipeline bypass from existing sewer line at K-4-54 to SSMH -37. Pipeline must be laid at invert of existing manhole at K-4-54 to invert of new manhole at SSMH MH-37.
- 7 Remove temporary overland bypass pipeline and pumps.

77-3.03B(10) Sewer Bypassing, Phase 9

Sheets SS-9 and SS-10 show requirements to connect to existing sewer upstream of new sewer manhole SSMH-37 to the existing modified manhole SSMH K-4-59:

- 1 Construct sewer line and sewer manholes from SSMH-37 to SSMH-42. Test, and place into service.
- 2 Modify existing sewer manhole SSMH K-4-62 and construct sewer line from existing SSMH L-4-62 to SSMH-38. Test and place into service.
- 3 Modify existing sewer manhole SSMH K-4-59 and K-4-58 and construct sewer line from these to SSMH-42. Test and place into service.
- 4 Plug downstream sewer at existing SSMH L-4-59 and K-4-58. Plug upstream manholes at K-4-54 and K-4-58.
- 4 Remove Phase 8 temporary flow through bypass.
- 5 Abandon in-place existing sewer system from SSMH K-4-59 at Gird Rd to K-4-54.

77-3.03B(11) Sewer Bypassing, Phase 10

Sheets SS-11 and SS-12 show requirements to connect to existing sewer upstream of new SSMH-50 the existing SSMH J-6-22.

- 1 Modify Manhole Base at the existing SSMH-50 and SSMH J-6-22.
- 2 Construct sewer line from the new SSMH-50 to the existing SSMH J-6-22.
- 3 Construct sewer line from SSMH-53 up to force man at SSMH J-6-29, and prepare to connect existing force-main to new sewer line but do not connect.
- 4 Coordinate with the Engineer for temporary shutdown of the force main at existing manhole SSMH J-6-29. Make this connection during off-peak/low-flow nighttime work within a 6-hour window. Provide pump-and-haul at opposite end of force main as required to ensure that sewer wet-well does not overflow.
- 5 Connect existing force main at SSMH J-6-29 to new SSMH-53. Terminate pump-and-haul at opposite end of force main once this connection is complete.
- 6 Plug downstream sewer line at existing manhole SSMH J-6-22, SSMH J-6-29 and upstream of SSMH-50 and SSMH J-6-29.
- 7 Abandon in-place the existing sewer system between SSMH-50 and the existing SSMH J-6-22.

77-3.03C Install Sewer Line

77-3.03C(1) General

PVC sewer line and fittings must comply with ASTM D2321, and Uni Bell pamphlet Uni-B-5 for *The Recommended Standard Specification for Polyvinyl Chloride (PVC) Fabricated Pressure Fittings*, and manufacturer's recommendations and as shown.

Pipe must be laid without break, upgrade from structure to structure, with the bell ends of the pipe upgrade. Pipe must be laid to the line and grade to form a concentric joint with the adjoining pipe and prevent offsets of the flow line. The spigot end must be inserted to the proper depth of the socket as indicated by the home mark.

77-3.03C(2) Install Sewer Branches

PVC wyes, and other types of branches must be furnished and installed along with PVC pipe to form the connection to the existing laterals as shown. The longitudinal barrel of branch fittings, in line and grade with pipe, must be of the same diameter, quality, and type for pipe.

The branch of wye fittings must be inclined upward at an angle not greater than 45 degrees from a horizontal line. Do not place wye closer than 5-feet in the downstream side to the centerline of a structure. No two wyes or tees must be laid back to back. There must be a minimum of 3-feet between each branch fitting.

77-3.03C(3) Connect Sewer line to Manhole

Place a 2-foot PVC pipe of the same inside diameter as the adjoining pipe at the inlet and outlet to each manhole or structure.

Directly cast a manhole coupling into the manhole base.

Connect sewer casing to manhole as shown.

77-3.03D Install Manhole Base

77-3.03D(1) General

The invert of the cast-in-place base must be hand-worked to provide channels conforming in size to the inside diameter of the piping. The channels must vary uniformly in size and shape from inlet to outlet. The concrete base must be shaped with a wood float and must receive a hard steel trowel finish before the concrete sets. A template must be used to accurately form the level surface that receives the first precast section.

Before constructing cast-in-place bases, sewer lines and stub piping must be in place, including ring-type seals. Manhole invert and alignment must be verified immediately on placement of concrete to assure that the sewer lines are in proper position before the concrete taking an initial set. The manhole base must extend 12-inches below the bottom of the lowest pipe and 6-inch above the top of the largest pipe.

Cast-in-place bases must set a minimum of 24 hours before the manhole construction is continued or as approved.

1. All joints must be sealed using flexible gasket material.
2. Cure all concrete for 10 days and protect from damage. If manhole is located in pavement area, do not adjust to final grade until pavement is complete.
3. Apply polyurethane and epoxy protective lining systems.
4. Construct PVC liner.
5. Shape the inside of the manhole base where new connection is made and the new manhole to comply with the size and shape of the lower portion of the manhole inlets and outlets. Cover concrete base with epoxy coating.
6. No carrier pipe can project more than 2-inches into a manhole. Do not build the bell of a pipe into the manhole base.
7. Test installed pipe to ensure that vertical deflection of plastic pipe does not exceed maximum allowable deflection. Maximum allowable deflection is governed by stated mandrel requirements and are nominally 5 percent.
8. Uncover any over-deflected pipe and reinstall. Remove damaged pipe from site and install new pipe.

77-3.03D(2) Installing Manhole Sections

The concrete manhole base and successive precast sections must receive a mastic joint sealing compound before setting the precast sections in place. Following the vacuum testing, the joints must be mortared and tooled to a smooth finish, free of voids. That sewer manholes are to be vacuum tested following assembly of the concrete sections, but before mortaring the joints, or backfilling.

Manhole components must have a PVC liner and polyurethane coating installed and tested under these specifications and the liner and coating manufacturer's recommendations. On assembly of the precast sections and vacuum testing, the mortaring and finishing of joints must be performed. The PVC liner seams at the joints must then be welded. The PVC liner must be secured by insertion between the uppermost grade ring and the manhole cover frame. PVC lined sewer manholes are to be vacuum tested following assembly of the concrete sections, but before mortaring the joints, welding the seams of the PVC liner, or backfilling. The polyurethane coating of exposed concrete on the manhole base must follow completion of the entire installation and construction activity within the manhole.

Assemble the precast sections to the elevation required by the location of the manhole as follows:

1. For paved areas, top of cover must be flush with the finished paving surface.
2. For travel way including shoulder, top of cover must be flush with the existing surface of the traveled way.
3. For unpaved area, top of cover must be 12-inches above the ground surface. Guard posts around the vault may be approved.

Secure the manhole frame to the grade ring with mortar.

After the frame is securely set, install the manhole lid, as shown.

Piping installation adjacent to the manhole and connection to the base or shaft sections must be performed. Piping Install flexible pipe connectors per manufacturer's recommendations .Prior to completion of sewer system, the new inlet to existing tie-in manholes and the outlet of the first new upstream manhole must be sealed with expandable plugs. The Engineer must approve the location of the plugs. Plugs must be removed at final inspection. Remove construction debris and water before the removal of plugs.

Brick or mortar bulkheads must be installed at the manhole end of unused stub channels for 36-inch beyond manhole base. New connections to existing manholes, without stubs, must be made by core drilling through the walls or base as ordered. Apply a protective epoxy coating to the cored concrete and the ends of reinforcing steel exposed. The protective epoxy coating must be an epoxy-resin based material with high bond strength to steel and concrete surfaces, and must conform to ASTM C881.

A concrete collar must be cast around manhole frames.

Replacement of asphalt or concrete pavement as needed.

77-3.03D(3) Install PVC Liner and Polyurethane Coating

Install PVC liner on precast shaft sections, cone sections and grade rings on the interior surface of manholes. Install the 100 percent solids elastomeric polyurethane coating to exposed concrete at the interior of precast and cast-in-place bases in the field.

77-3.03D(4) Apply Damp-Proofing

Apply damp-proofing material to the exterior surfaces of manholes under the manufacturer's recommendations. The material must be applied to exterior surfaces below a point 12-inch above the water table or indications of seepage or moisture as ordered by the Engineer.

77-3.04 PAYMENT

Not Used

AA

78 PIPE JACKING

Replace “RESERVED” in section 78 with:
TRENCHLESS CASING INSTALLATION

78-1.01 GENERAL.

78-1.01A Summary

Section 78-1 includes general specifications for furnishing and constructing pipe jacking installations.

Pipe jacking is a trenchless construction method for installing a prefabricated pipe through the ground behind a shield or a tunnel boring machine from a drive shaft to a reception shaft.

Notify the Engineer at least 15 days before starting jacking work.

78-1.01B Definitions

Not Used

78-1.01C Submittals

Do not begin pipe jacking operations until approval of your complete submittal package.

Within 30 days of contract approval, submit a 3-ring binder with labeled sections for the following action submittals:

1. Plans and calculations for control and diversion of ground water or flows in existing pipes, including:
 - 1.1. Selection of a diversion system and equipment based on compatibility with the properties, characteristics, and behavior of the soils as indicated by the soils investigation report
 - 1.2. Calculations supporting the capacity and sizing of the flow diversion system
 - 1.3. Schedule and duration of the flow diversion
2. Manufacturers' data sheets and specifications for the pipe jacking equipment, jacking frame, and all ancillary equipment to be used in the installation
3. Description of the method for removing and disposing of spoil, including:
 - 3.1. Location of disposal sites
 - 3.2. Sample log of volume of spoil removed relative to the advancement of the pipe
4. Description of the grade and alignment control system, including:
 - 4.1. Indicator of the location of the pipe's leading edge with respect to line and grade
 - 4.2. Intervals for checking line and grade
 - 4.3. Manufacturer's product literature and drawings showing set-up, support provisions, and other details for the water level and laser or theodolite systems
 - 4.4. Surveying methods for confirming that the thrust block, guide rails, and jacking frame are installed on the proper line and grade. Submit survey results prior to the launch of each drive to ensure that the thrust block, jacking frame, and guide rails are installed properly.
 - 4.5. Data demonstrating these systems can achieve the line and grade as shown within the specified tolerances
 - 4.6. Samples of grade and alignment progress reports
5. Description of the method for centering the cutting head inside the borehole
6. Design calculations confirming the proposed jacking pipe is capable of supporting the maximum stresses anticipated during jacking operations
 - 6.1. Assumptions used in your calculations must be consistent with the information in the geotechnical investigation report.
 - 6.2. Calculations must include earth and hydrostatic loads, jacking forces, external loads such as live loads due to traffic, and any other loads that may be reasonably anticipated during jacking. Describe and show all loads and the assumed maximum drive length.
 - 6.3. Provide an estimate of the maximum jacking force expected to complete the drive, accounting for frictional resistance along the pipe.
7. Calculations demonstrating the soils behind the thrust block can transfer the maximum planned jacking forces exerted by the main jacks to the ground with a factor of safety of at least 2.0 without excessive deflection or displacement

8. Methods for preventing voids and for grouting
9. Design and layout drawings of the pipe jacking pits, including:
 - 9.1 Surface construction
 - 9.2 Profile and depth
 - 9.3 Method of excavation
 - 9.4 Shoring and bracing
 - 9.5 Thrust block design
 - 9.6 Dimensions and locations of all jacking equipment
10. Pipe design data and specifications required to withstand the jacking pressure
11. Locations and design of intermediate jacking stations, if any.
12. Description of the lubrication injection system, including:
 - 12.1 Manufacturer's product literature and MSDS for the lubricant
 - 12.2 Estimated volume of lubricant that will be pumped
 - 12.3 Lubrication procedures
13. Plan for monitoring ground surface movement caused by the jacking operation, including
 - 13.1 Method, locations, and frequency of survey measurements
 - 13.2 Preconstruction and postconstruction assessments of any roadways or structures located within 100 feet of the pipe's centerline and the pipe jacking pits
 - 13.3 Procedures for avoiding excessive settlement
 - 13.4 Photographs or video of existing damage to structures near the pipe's alignment
14. Layout plan and description of the pipe jacking sequence
15. Procedures for complying with Cal/OSHA requirements under section 7-1.02K(6), including
 - 15.1 Safety procedures and equipment for shaft access and exit
 - 15.2 Ventilation and lighting
 - 15.3 Monitoring for hazardous gases
 - 15.4 Protection against soil instability, ground water inflow, and flooding
 - 15.5 Safety procedures for handling mechanical and hydraulic equipment
 - 15.6 Emergency evacuation procedures
16. Contingency plans for the following conditions: damage to the pipe; loss and return to line and grade; sudden or large increase in jacking forces; contact with an unexpected obstruction or utility; boring machine becomes stuck; jacking forces reach design capacity of the pipe, jacking frame, or thrust block, grade tolerances are exceeded.
17. Casing spacers and end seals.

Plans, working drawings, and calculations for pipe jacking operations must be sealed and signed by an engineer who is registered as a civil or structural engineer in the State. The Department will schedule a preconstruction meeting with you, your subcontractors, and other involved parties following acceptance of all submittals.

Submit a list with descriptions of similar projects that successfully used the proposed pipe jacking system.

Submit any deviations for casing pipe thickness that exceeds as specified in section 78-1.02B(2) 14 days in advance of work.

78-1.01D Quality Control and Assurance

78-1.01D(1) General

Assign a representative who is thoroughly knowledgeable about the pipe jacking equipment and operations to be present during pipe jacking operations and to address concerns and emergencies.

78-1.01D(2) Daily Operations Logs

By noon the next day after completion of a work shift, submit daily pipe jacking and lubrication logs.

Record observations at intervals of no less than 3 times per pipe, as conditions change, or as directed.

The daily pipe jacking log must include:

1. Date and times of observations
2. Pipe jacking operator's name
3. Tunnel drive identification

4. Installed length of pipe and corresponding tunnel length
5. Rate of advance
6. Jacking forces
7. Problems encountered with the pipe jacking machine or other equipment
8. Durations and reasons for delay

The daily lubrication log must include:

1. Injection locations along the pipe
2. Volume of lubricant pumped throughout a drive
3. Types and amounts of additives used and the time and drive distance when used

78-1.01D(3) Field Leakage Testing

Notify the Engineer and stop work immediately if there is any indication the casing pipe has been damaged and may leak. If requested, perform a hydrostatic pressure test within 24 hours in the Engineer's presence. Use one of the following test methods:

1. Field leakage testing for culvert and drainage pipes under section 61-1.01D(2)(a)
2. Water leakage test for leak-resistant joints. A maximum allowable leakage of 1,000 gallons per inch of nominal diameter per mile of pipe length per day is allowed under a hydrostatic head of 6 feet above the crown. If authorized, you may use an air-based joint-by-joint leakage test.
3. No leakage will be allowed for welded steel casing.

Submit a copy of your test results. Repair and retest the failed joints or pipe sections at your expense until they comply with the maximum allowable leakage.

78-1.01D(4) Subsurface Monitoring

An independent specialist must install and operate instrumentation to measure surface and subsurface settlement. The survey accuracy of the settlement monitoring points must be within 0.01 feet.

Subsurface monitoring points must be established at 5 feet and 10 feet above the crown of the proposed tunnel near the jacking shaft, above utilities, on shoulders of the roadway, and at noncritical locations. Surface monitoring points must be established to supplement subsurface monitoring points. Surface settlement must be measured daily or hourly when the heading is within 25 feet of the surface. If from 1/4 to 1/2 inch of settlement is measured, you must take corrective action including filling the voids with grout and limiting the radial overcut.

Surface settlement points located in traffic lanes must be checked before and after tunneling. If 1/4 inch or more of settlement is measured, you must take corrective action including filling the voids with grout.

78-1.01D(5) Completed Installation Inspection

Inspect the entire length of the completed pipe-jacking installation using CCTV or human entry. Provide a copy of the inspection video in DVD format and with written logs of any problem locations.

78-1.02 MATERIALS

78-1.02B(1) General

Casing spacers must be of stainless steel, centered-position type with PVC liner and non-metallic anti-friction runners as shown in the "*Approved Water and Sewer Materials List*" in the Information Handout.

Warning/Identification tape must comply with section 77-1.02D.

Sand must comply with section 77-2.02(D).

78-1.02B(2) Pipe Casing

Jacked pipe casings must be of steel. The minimum size and wall thickness of jacked steel pipe casing must be as follows, unless as shown.

Carrier Pipe Size	Minimum Casing Size (internal size)	Min. Steel Casing Wall Thickness
6"	14"	3/8"
8"	20"	1/2"
10"	20"	1/2"
12"	20"	1/2"
16"	30"	1/2"
18"	30"	1/2"
20"	36"	1/2"
24"	42"	1/2"

Pipe casing for carrier pipe larger than 24" will be determined by the Engineer

Steel pipe casings, must be butt-welded sheets and comply with ASTM A 361A 36M, ASTM A 2831 A 283M, Grade D, or ASTM A 5701A 570M, Grade 33 or as approved.

78-1.02B(3) Casing End Seals

Casing end seals must wrap around the casing and carrier pipe to provide a barrier to backfill material and seepage. The casing end seal must be a minimum 1/4-inch thick styrene butadiene rubber sheet attached to the carrier pipe and casing with 1-inch wide stainless steel bands. Zippered casing end seals with stainless steel bands may also be used.

78-1.02B(4) Slurry

Use a slurry for soil stabilization during pipe jacking. The slurry must:

1. Be a mixture of bentonite clay and potable water
2. Have a minimum pH of 6.0
3. Include only approved chemical additives

Identify the source of water for mixing the slurry. Obtain approvals and permits for using water from sources such as streams, rivers, or ponds. A pH test may be required if you use nonpotable water.

78-1.02B(5) Grout

Grout must consists of one part portland cement concrete for one part sand, 2% bentonite by weight of the cement and sufficient water to provide a workable moisture.

78-1.03 CONSTRUCTION

78-1.03A General

Completely contain all pipe jacking equipment and operations within the allowable work areas.

Excavation and backfill must comply with section 19.

Monitor water pollution control practices at the job site. Handle and dispose of wastewater generated by pipe jacking operations under section 13-2.

Place a 6 foot chain link fence and Type K temporary railing around the pipe jacking pits and shore the jacking pits to comply with Cal/OSHA requirements. For jacking pits located within 15 feet of traffic lanes, do not extend the shoring more than 3 feet above the pavement. Attach reflectors to the shoring on the sides facing traffic.

Jacking pits must have bottoms of crushed rock or concrete slabs and sumps to clear ground water and water used to clean casings. Line the pits with filter fabric if ground water is encountered.

Equipments in the trench of the jacking pit must be firmly bedded on the required line and grade using heavy timbers, structural steel, or concrete cradles of sufficient length.

Provide sufficient space for inserting jacked casings. Place a timber or structural steel bearing block between the jacks and the end of the casing to provide uniform bearing upon the casing end evenly distribute the jacking pressure.

After removing jacking equipment and debris from the approach trench of jacking pit, prepare the bottom of the jacking pit for pipe foundation. Remove all loose and disturbed materials below pipe grade to undisturbed earth and re-compact the material in accordance with section 19-2.

78-1.03B Pipe Jacking Operations

Pipe jacking pits and shafts must be large enough to accommodate all equipment and the selected pipe and to provide safe working conditions.

Use thrust blocks designed to distribute loads uniformly such that:

1. Deflection of the thrust block is uniform
2. Excessive loads are not exerted on the shaft
3. Jacking frame does not become misaligned

The jacking system must push the pipe through the ground in a controlled manner and sustain the anticipated jacking loads. Monitor the jacking force applied to the pipe and do not exceed the pipe manufacturer's recommendations.

Ensure the lubrication injection system is functional at all times and capable of reducing jacking loads. Use pipe lubrication systems and pumps to convey the lubricant to the injection points. Keep sufficient lubricant on site to avoid loss of lubrication.

Once pipe jacking has started, continue jacking without interruption until the pipe has reached the specified distance. If authorized, you may use a different jacking sequence and method to ensure continued advancement of the pipe and stability of the heading at all times.

Protect the driving ends of the pipe against spalling or other damage.

Repair or replace any damaged or failed section of pipe at your expense.

If an obstruction prevents completion of the work, plug and abandon the pipe.

At your expense, repair or replace any roadways or structures damaged by settlement or heaving caused by pipe jacking operations.

78-1.03C Pipe Casing Installation

Installation of pipe casings must be as shown and comply with the following:

Place pipe casing to permit the installation of the carrier pipe to the lines and grades as shown.

Gravity flow pipelines are designed at grades that do not permit variance from the lines and grade as shown.

Fit a sectional shield or steel jacking head to the leading section of the casing. The shield or head must extend around the outer surface of the upper two-thirds of the casing and project at least 18-inch beyond the driving end of the casing. The shield or head must not protrude more than 1/2-inch beyond the outer casing surface.

The leading section of casing must be equipped with a jacking head securely anchored to prevent any wobble or variation in alignment during the jacking operation.

Carry out excavation entirely within the jacking head and not in advance of the head. Excavated materials must be removed from the casing as jacking progresses and no accumulation of excavated material within the casing will be permitted.

A jacking band for reinforcing the end of the pipe receiving the jacking thrust is required.

Control the application of jacking pressure and excavation of material ahead of the advancing casing to prevent it from becoming friction-bound or deviating from required line and grade. Do not encroach upon the minimum annular space detailed. Restrict the excavation of material to the least clearance to prevent binding in order to avoid settlement or possible damage to overlying structures or utilities.

Steel casing sections must be full-circumference butt-welded in the field. Provide stress transfer across the joints capable of resisting the jacking forces involved.

Immediately after the completion of the casing installation, grout must be injected through the grout connections of casings 30-inch in diameter or larger to fill voids outside the casing pipe. Grout pressure must be controlled to avoid deformations of the casing or movement of the surrounding ground. After the completion of the grouting, the grout connections must be closed with extra heavy steel threaded plugs.

78-1.03D Carrier Pipe Installation

Carrier pipe must be inserted into the casing with casing spacers as follows:

PVC carrier pipe joints must be restrained either by mechanical means or by use of splined gaskets. PVC carrier pipe must comply with section 77-3.02C.

Upstream and downstream elevations of the carrier pipe must be verified via surveying prior to installing the end seals.

The portion of carrier pipe installed within a casing must have pressure, leakage, and infiltration testing completed in accordance with section 77-3.01B prior to installation of the end seals.

The annular space between the carrier pipe and casing must be filled with air blown sand.

78-1.03E Casing Spacers

Casing spacers must be used to prevent the carrier pipe from touching the casing and to maintain a uniform space between the carrier pipe and casing interior.

Casing spacers must be installed on the carrier pipe at intervals per the manufacturer's recommendations with a minimum of 3 spacers per pipe section equally spaced, and as shown.

The carrier pipe grade must be adjusted as required by changing the height of the casing spacer riser.

78-1.03F Casing End Seals

Casing end seals must be installed per manufacturer's recommendations. Carrier pipe must pass hydrostatic or leakage tests per section 77-2.01B(4) prior to the installation of casing end seals or backfilling operations.

78-1.03G Excess Fluids and Spoil

Monitor the pumping rate, pressure, viscosity, and density of the boring fluids to ensure the stability of the borehole and adequate removal of spoil. Contain excess boring fluids, slurry, and spoil at the entry and exit points of the jacking pits.

Dispose of or recycle all boring fluids.

If jacking and boring in suspected contaminated soil, test the boring fluids and soil cuttings for contamination. Notify the Engineer immediately if there is contamination and stop work. Dispose of any contaminated soil and fluids appropriately.

Remove all spoil upon completion of jacking.

78-1.04 PAYMENT

Jacked pipe is measured parallel with the slope line along the centerline of the pipe. No payment is made for jacked pipe placed in excess of the designated length.

No payment is made for failed bore paths, removal of materials installed in a failed bore path, injection of excavatable flowable fill, products taken out of service, or incomplete installations.

78-2 AUGER BORING

78-2.01 GENERAL

78-2.01A Summary

Section 78-2 includes specifications for furnishing and construction auger boring installations.

Auger boring is a trenchless construction method that forms a borehole from a drive shaft to a reception shaft by means of a rotating cutting head with limited tracking and steering capability. Spoil is transported back to the drive shaft by helical wound auger flights rotating inside of a steel casing that is being jacked in place simultaneously. It does not provide continuous support to the excavation face. Auger boring may be either a 1-stage (i.e. casing installation only) for culverts or 2-stage process (i.e. casing installation and product pipe installation) as shown.

Auger boring is used at location where groundwater is not encountered.

78-2.01B Definitions

Not used.

78-2.01C Submittals

Not used.

78-2.01D Informational Submittals

Not used.

78-2.01E Quality Control and Assurance

Comply with section 78-1.01A.

The project superintendent and operator must have at least 3 years of auger boring experience and must have completed least 2 projects of similar diameter and length in similar ground conditions using pipe ramming equipment similar to the equipment required for this project.

78-2.02 Materials

Comply with section 78-1.02

78-2.03 Construction

Do not begin auger boring until you have surveyed the orientation and grade of the jacking frame and guide rails and verified that they are properly supported.

Auger and casing must be pushed simultaneously. The rear of the cutting head must not advance in front of the leading edge of the casing by more than 1/3 times the casing diameter. In stable cohesive conditions the rear of the cutting head must not advance in front of the leading edge of the casing by more than 8 inches.

In unstable conditions, such as granular soil, loose or flowable materials, the cutting head must be retracted into the casing a distance that permits a balance between pushing pressure, pipe advancement and soil conditions. A suitable band welded around the leading edge of the casing must be installed to provide additional strength in loose unstable materials when the cutting head has been retracted into the casing to reduce skin friction and to provide a method for the slurry lubricant to coat the outside of the casing.

If wing cutters are used, use a maximum excavation of 1 inch to the outside diameter of the steel casing.

Provide at least 20 feet of full diameter auger at the leading end of the casing. Subsequent auger size may be reduced, but the reduced auger diameter must be at least 85% of the casing inside diameter. The length of auger must be equal to that of the section of steel casing.

Do not leave conduit open ended without approval of the Engineer to prevent the conduit from acting as a drainage structure prior to finished installation.

Auger boring equipment selected for the project must be suitable for advancing through the geologic conditions described in the Geotechnical Design Report. The machine must be capable of excavating cobbles or boulders or other objects up to 30% of the outside diameter of the augers.

Upon completion of the jacking operations, voids visually determined at each end in excess of 1 inch must be grouted. Upon completion of grouting, holes must be plugged with steel or PVC caps.

The carrier pipe must be installed after successful installation of casing pipe. You must attach pre-manufactured casing spacers inside the carrier pipe before installation. The carrier pipe must be installed, one piece at a time, from either the entry or exit pit. Carrier pipe may be installed by pushing by hand or with a boring/jacking machine. All voids in the annular spacing between the carrier pipe and the casing must be filled with air blown sand.

Ends of casing must be sealed with mortar, neoprene seals or another approved method.

78-2.04 Payment

Not used.

78-3 PIPE RAMMING

78-3.01 GENERAL

78-3.01A Summary

Section 78-3 includes specifications for furnishing and installing welded steel pipe casing by via trenchless installation as shown.

Pipe ramming is a non-steerable trenchless pipe installation method whereby an open-ended steel casing is driven through the ground using a percussive hammer. The soil may remain in the casing until the bore has been completed or may be removed at intervals during the installation by water, augering, jet-cutting, or manual excavation to reduce frictional resistance. Once the crossing is completed, all soil is removed from the casing. Pipe ramming may be either a 1-stage (i.e. casing installation only) for culverts or 2-stage process (i.e. casing installation and product pipe installation) as shown.

78-3.01B Definitions

Not used.

78-3.01C Submittals

For each pipe ramming installation, submit a 3-ring binder with labeled sections for the following action submittals:

1. Detail drawings and specifications for the cutting shoe that will be used. Submit the excavation diameter based upon the outermost dimensions of the cutting shoe. Provide the radial overcut which is the difference between the maximum excavation diameter and the outer diameter of the casing pipe, divided by two.
2. Details of the thrust cone and adapter that will be used to connect the pneumatic hammer to the steel casing.
3. Details and written description of slope protection and portal stabilization measures, including a work plan for their installation and removal and supplemental soil stabilization measures (sand bag walls, etc.) that will be used inside the casing to prevent soil from sloughing or flowing into the casing during hammering.
4. Name and resume for pipe ramming equipment manufacturer's representative if you elect to use manufacturer's representative to meet operator experience requirements.

78-3.01D Quality Control and Quality Assurance

Comply with section 78-1.01A.

78-3.01D(1) Qualifications

The project superintendent and operator must have at least 3 years of pipe ramming experience and must have completed least 2 projects of similar diameter and length in similar ground conditions using pipe ramming equipment similar to the equipment required for this project.

You may substitute a full-time on-site pipe ramming equipment manufacturer's representative with the requisite experience to fulfill the operator experience requirements.

78-3.01D(2) Daily Operations Logs

Record hammer strokes per minute and operating pressure. Manually recorded observations must be made at intervals of at least four times per 20-foot pipe. Comply with 78-1.01A(4)(c).

78-3.01E Design Criteria

You are responsible for casing design for ramming loads and acceptable fabrication tolerances. Maximum installation loads applied to the casing pipe must not exceed 50% of the ultimate compressive strength of the pipe material or the maximum allowable strength of the pipe as established by the manufacturer, whichever is lower.

78-3.02 MATERIALS

78-3.02A Pipe Ramming Equipment

Use pneumatic pipe ramming equipment manufactured by TT Technologies Inc., Vermeer or Grundoram HammerHead, or an Engineer-approved equal. Pipe ramming equipment selected for the project, including the pneumatic hammer, cutting shoe, steel casing, and lubrication injection system must be capable of efficiently advancing through the existing ground conditions and breaking or excavating boulders or other objects up to 30% of the outside diameter of the casing pipe and up to an unconfined compressive strength of 30,000 psi.

The soil removal system must be capable of being operated in a manner which will prevent loss of ground outside the casing during any intermediate spoil removal.

78-3.02B Casing

Comply with section 78-1.02B(2) and conform to requirements specified.

78-3.03 CONSTRUCTION

78-3.03A General

Pipe ramming must not begin until all entry and exit portal stabilization measures have been completed, including installation of blast maps on the downstream slope.

Once pipe ramming has started, continue ramming without interruption until the pipe has reached the distance shown.

78-3.03B Site Preparation

Install pipe guide rails in accordance with alignment and grade shown. Launch area must properly support guide rails and pipe.

Stabilize the road embankment such that it is not damaged by excavation or pipe ramming operations.

78-3.03C Pipe Ramming

Ram pipe sections into position as shown without damaging the pipe. If a section of pipe is damaged, comply with your authorized contingency plan. Use a hammer frame and ramming cone system to develop a uniform distribution of ramming forces around the perimeter of the casing pipe.

Each pipe section must be rammed forward in such a way to provide complete and adequate ground support at all times. Leave a sufficient soil plug inside the casing at all times to prevent sloughing of soils outside the leading edge of the casing. Do not exceed your authorized radial overcut dimension.

The amount of lubrication directed to the outside of the pipe must fill the void between the outside of the pipe and soil, as created by the soil shoe. Lubrication to the inside of the casing must be adequate to assist in spoil removal when the ram is completed.

78-3.03D Obstructions

Notify the Engineer immediately if the pipe ramming operations encounter an object or condition that prevents the forward progress of the casing. Comply with your authorized contingency plan.

You will not receive additional compensation for removing, clearing, or otherwise making it possible for the casing pipe to advance past objects consisting of cobbles, boulders, wood, non-reinforced concrete, and other nonmetallic objects or debris with maximum lateral dimensions less than 30% of the outer diameter of the casing pipe.

4. Loose or unsound knots
5. Multiple crooks
6. Other defects that would weaken the wood or otherwise make it structurally unsuitable for the purpose intended

80-4.02B Rails and Posts

Rails and posts must be pressure treated Douglas Fir conforming to section 57.

80-4.02C Object Markers

Object markers must comply with section 82.

80-4.02D Stain

Stain all exposed surfaces with two coats of a commercial quality, base white with no tint, solid acrylic stain.

Apply the stain in accordance with the manufacturer's recommendations.

80-4.02E Hardware

Galvanize all hardware in conformance with section 75-1.05.

80-4.03 PAYMENT

Not Used

**Replace section 80-5 with:
80-5 CABLE BARRIER FENCE**

80-5.01 GENERAL

80-5.01A Summary

Section 80-5 includes general specifications for constructing cable barrier fence.

Cable barrier fence must conform to section 83-1.02E.

Galvanize cable barrier fence in conformance with section 75-1.05.

Stain cable barrier fence with Natina Steel in conformance with section 59-11.

80-5.02 PAYMENT

Not Used

Add between the 10th and 11th paragraphs in section 80-10.02:

Stain all exposed galvanized surfaces (including hardware) with Natina Steel in accordance with section 59-11.

**Replace section 80-11 with:
80-11 TUBULAR STEEL GATE**

80-11.01 GENERAL

80-11.01A Summary

Section 80-11 includes general specifications for tubular steel gates Type 1, Type 2, and Type 3.

80-11.01B Definitions

gate unit for rail fence: 1 gate with fittings, hardware, and gate and latch post with braces.

gate unit for cable barrier fence: 1 gate with fittings, hardware, and gate and latch post with braces.

DIVISION IX TRAFFIC CONTROL FACILITIES

83 RAILINGS AND BARRIERS

Replace item 1 in the 7th paragraph of section 83-1.02B with:

1. Steel, posts

Replace item 2 in the 7th paragraph of section 83-1.02B with:

2. Wood or plastic blocks for line posts

Add to section 83-1.02B:

The offset from the face of the Type WB-31 transition railing to the hinge point must be a minimum of 3'-6".

The offset from the face of the adjacent midwest guardrail system to the hinge point must be transitioned from the offset at the Type WB-31 transition railing to 4'-0" using a ratio of 6:1.

Replace section 83-1.02C(2) with:

83-1.02C(2) Alternative In-Line Terminal System

Alternative in-line terminal system must be furnished and installed as shown on the plans and under these special provisions.

The allowable alternatives for an in-line terminal system must consist of one of the following or a Department-authorized equal.

1. TYPE SKT-MGS TERMINAL SYSTEM - Type SKT-MGS terminal system must be a SKT 350 sequential kinking terminal, system length 53'-1-1/2", manufactured by Road Systems, Inc., located in Big Spring, Texas, and must include items detailed for Type SKT-MGS terminal system 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 13th Street, S.W., Canton, OH 44708, telephone (330) 477-4800.
2. TYPE ET-31 TERMINAL SYSTEM - Type ET-31 terminal system must be an ET-31 (4-tube system) extruder terminal, system length 53'-1-1/2", as manufactured by Trinity Highway Products, LLC, and must include items detailed for Type ET-31 terminal system shown on the plans. The ET-2000 PLUS (4-tube system) extruder terminal can be obtained from the manufacturer, Trinity Highway Products, LLC, P.O. Box 99, Centerville, UT 84012, telephone (800) 772-7976.
3. TYPE 31" X-TENSION - Type 31" X-Tension terminal system must be a 31" X-Tension Guard Rail End Terminal as manufactured by Barrier Systems, Inc., located in Vacaville, CA, and must include items detailed for Type 31" X-Tension terminal system shown on the plans. The 31" X-Tension Guard Rail End Terminal can be obtained from the distributor, Statewide Safety and Signs, Inc., 130 Grobri Court, Fairfield, CA 94533, telephone (800) 770-2644.

Submit a certificate of compliance for terminal systems.

Terminal systems must be installed under the manufacturer's installation instructions and these specifications. Each terminal system installed must 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. Paint must be metallic acrylic resin type spray paint. Before applying terminal system identification, the surface to receive terminal system identification must be removed of all dirt, grease, oil, salt, or other contaminants by washing the surface with detergent or other suitable cleaner. Rinse thoroughly with fresh water and allow to fully dry.

For Type ET-31 terminal system, install a hinged breakaway post at Post 1 and 6'-0" steel yielding terminal posts at Posts 2 through 6. The hinged breakaway post must be, at the Contractor's option, either driven, with or without pilot holes, or placed in drilled holes. If placed in a pilot or drilled hole, space around the hinged breakaway post must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted.

For Type SKT-MGS terminal system, install the soil tube with soil plate attached at Post 1, hinged breakaway post at Post 2, and 6'-0" W6 x 9 steel posts at Posts 3 through 8. Use a W6 x 15 steel post at Post 1. The soil tube with soil plate must be, at the Contractor's option, driven with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted.

For Type 31" X-Tension terminal system, the steel bottom post and I-beam post must be placed in drilled hole. The soil anchor and steel line posts must be, at the Contractor's option, either driven or placed in drilled holes. Space around the steel bottom post, steel line posts and soil anchor must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted. All blocks must be plastic.

After installing the terminal system, dispose of surplus excavated material in a uniform manner along the adjacent roadway where designated by the Engineer.

Replace section 83-1.02C(3) with:

83-1.02C(3) Alternative Flared Terminal System

Alternative flared terminal system must be furnished and installed as shown on the plans and under these special provisions.

The allowable alternatives for a flared terminal system must consist of one of the following or a Department-authorized equal.

1. TYPE FLEAT-MGS TERMINAL SYSTEM - Type FLEAT-MGS terminal system must be a Flared Energy Absorbing Terminal 350, system length 37'-6", manufactured by Road Systems, Inc., located in Big Spring, Texas, and must include items detailed for Type FLEAT-MGS terminal system 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 Industries, Inc., 4100 13th Street, S.W., Canton, OH 44708, telephone (330) 477-4800.
2. TYPE SRT-31 TERMINAL SYSTEM - Type SRT-31 terminal system must be an SRT-350 Slotted Rail Terminal (6-post system), system length 37'-6", as manufactured by Trinity Highway Products, LLC, and must include items detailed for Type SRT-31 terminal system shown on the plans. The SRT-350 Slotted Rail Terminal (6-post system) can be obtained from the manufacturer, Trinity Highway Products, LLC, P.O. Box 99, Centerville, UT 84012, telephone (800) 772-7976.
3. TYPE 31" X-TENSION - Type 31" X-Tension terminal system must be a 31" X-Tension Guard Rail End Terminal as manufactured by Barrier Systems, Inc., located in Vacaville, CA, and must include items detailed for Type 31" X-Tension terminal system shown on the plans. The 31" X-Tension Guard Rail End Terminal can be obtained from the distributor, Statewide Safety and Signs, Inc., 130 Grobri Court, Fairfield, CA 94533, telephone (800) 770-2644.

Submit a certificate of compliance for terminal systems.

Terminal systems must be installed under the manufacturer's installation instructions and these specifications. Each terminal system installed must 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. Paint must be metallic acrylic resin type spray paint. Before applying terminal system identification, the surface to receive terminal system identification must be removed of all dirt, grease, oil, salt, or other contaminants by washing the surface with detergent or other suitable cleaner. Rinse thoroughly with fresh water and allow to fully dry.

For Type SRT-31 terminal system, install a cable release post at Post 1 and 6'-0" steel yielding terminal posts at Posts 2 through 6. The cable release post and steel yielding terminal posts must be, at the Contractor's option, either driven, with or without pilot holes, or placed in drilled holes. If placed in pilot or drilled holes, space around the posts must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted.

For Type FLEAT-MGS terminal system, install the soil tube with soil plate attached at Post 1, hinged breakaway post at Post 2, and 6'-0" W6 x 9 steel posts at Posts 3 through 7. Use a W6 x 15 steel post at Post 1. The soil tube with soil plate must be, at the Contractor's option, driven with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted.

For Type 31" X-Tension terminal system, the steel bottom post and I-beam post must be placed in drilled hole. The soil anchor and steel line posts must be, at the Contractor's option, either driven or placed in drilled holes. Space around the steel bottom post, steel line posts and soil anchor must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted. All blocks must be plastic.

After installing the terminal system, dispose of surplus excavated material in a uniform manner along the adjacent roadway where designated by the Engineer.

Add between the 7th and 8th paragraphs in section 83-1.02E:

Stain all exposed galvanized surfaces (including hardware) with Natina Steel in accordance with section 59-11.

Replace the 14th paragraph in section 83-1.02I with:

Chain link fabric must be AASHTO M 181, Type 1, Class C.

Stain all exposed galvanized surfaces (including hardware) with Natina Steel in accordance with section 59-11.

Add to section 83-2.02D(1):

The concrete for concrete barrier rails type: Type 736 and Type 60 series must be integrally pigmented colored concrete. The color must match the referee sample located at Br. No. 57-1211, Ostrich Farm Creek Bridge.

Add between the 7th and 8th paragraphs in section 83-1.02E:

Stain all exposed galvanized surfaces (including hardware) with Natina Steel in accordance with section 59-11.

Add to section 83-2.02D(1):

The concrete for concrete barrier rails type: Type 736 and Type 60 series must be integrally pigmented colored concrete. The color must match the referee sample located at Br. No. 57-1211, Ostrich Farm Creek Bridge.

Replace the 2nd paragraph of section 83-2.02D(2) with:

Concrete for concrete barriers other than Type 50 and 60 series must contain not less than 630 pounds of cementitious material per cubic yard and must be air entrained. The air content at the time of mixing and before placing must be 3.0 ± 1.0 percent unless a higher air content is specified.

Replace section 83-2.02E(4) with:

83-2.02E(4) Type REACT Crash Cushion

Type REACT crash cushion must be installed where shown.

Type REACT crash cushion and additional components must comply with the descriptions shown in the following table:

Bid item description	Manufacturer's product description
Type REACT 9CBB crash cushion	REACT 350-36 concrete side mount

The successful bidder can obtain from the following distributors the Type REACT crash cushion manufactured by Energy Absorption Systems, Inc. at 35 East Wacker Drive, Suite 1100, Chicago, IL 60601-2076:

1. Northern California: Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828, telephone (916) 387-9733, FAX (916) 387-9734
2. Southern California: Traffic Control Service, Inc., 1818 E. Orangethorpe, Fullerton, CA 92831-5324, telephone (714) 526-9500, FAX (714) 526-9561

The price quoted by the manufacturer for Type REACT 9CBB crash cushion, FOB Pell City, Alabama is \$32,000, 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 Type REACT 9CBB crash cushion includes the concrete anchorage devices, but does not include the concrete anchor slab or the concrete backup block.

Install the crash cushion under the manufacturer's instructions.

Concrete anchorage devices used for attaching the crash cushion to the base slab must be limited to those that have been provided by the manufacturer.

The concrete anchor slab and backup block must comply with sections 51 and 52.

The concrete anchor slab and backup block must be constructed of concrete containing not less than 590 pounds of cementitious material per cubic yard.

Submit a copy of the manufacturer's plan and parts list, for each model installed, as an informational submittal.

Submit a certificate of compliance for each model of Type REACT crash cushion.

Payment for structure excavation, structure backfill, and concrete anchor slab and backup block with bar reinforcing steel is included in the payment for crash cushion (REACT 9CBB).

Replace "Reserved" in section 83-2.02F with:

Construct wildlife passage way in concrete barrier at the locations shown. Comply with section 83-2.

Construct the passage way opening by forming the opening in the concrete barrier or after the concrete barrier is constructed saw cut the outline of the opening and remove the concrete and bar reinforcing steel within the limits of the opening.

The finished opening for Type M wildlife passage way must be clear and unobstructed for the dimensions shown.

Construction of Type M wildlife passage way may require removal of concrete barrier. Before removal of the concrete barrier, a saw cut of approximately 1 inch in depth must be made on the face of the barrier along the removal limits.

Apply thermoplastic traffic stripe and both types of glass beads in a single pass. First apply the thermoplastic, followed immediately by consecutive applications of high-performance glass beads and then AASHTO M 247, Type 2, glass beads. Use a separate applicator gun for each type of glass bead.

You may apply glass beads by hand on pavement markings.

Distribute glass beads uniformly on traffic stripes and pavement markings. Apply high-performance glass beads at a rate of at least 6 lb/100 sq ft of stripe or marking. Apply AASHTO M 247, Type 2, glass beads at a rate of at least 8 lb/100 sq ft of stripe or marking. The combined weight of the 2 types of glass beads must be greater than 14 lb/100 sq ft of stripe or marking.

84-6.04 PAYMENT

Not Used

AA

86 ELECTRICAL SYSTEMS

Add to the end of the 1st paragraph of the RSS for section 86-1.01:

This work is shown on plan sheets labeled E, EE and SES. The work involved in each bid item is shown on a sheet with a title matching the bid item description except for the following bid items:

- 1. Maintaining the existing traffic management system during construction

Lighting equipment is included in the following structures:

- 1. Route 76, Live Oak Bridge. Bridg No. 57-1234 L/R.
- 2. Route 76, SDCWA pipeline OC. Bridge No. 57-1235 L/R

Communication conduit is included in the following structures:

- 1. Route 76, Live Oak Bridge. Bridg No. 57-1234 L/R
- 2. Route 76, SDCWA pipeline OC. Bridge No. 57-1235 L/R

Sprinkler control conduit is included in the following structures:

- 1. Route 76, Live Oak Bridge. Bridg No. 57-1234 L/R
- 2. Route 76, SDCWA pipeline OC. Bridge No. 57-1235 L/R

Traffic signal work must be performed at the following locations:

- 1. RTE 76 and Thoroughbred Ln.
- 2. RTE 76 and South Mission Rd.
- 3. RTE 76 and Via Monserate.
- 4. RTE 76 and Gird Rd.
- 5. RTE 76 and Old Highway 395
- 6. Old HWY 395 and Via Altimira

Add to the list in the 5th paragraph of the RSS for section 86-1.03:

- 14. Closed Circuit television camera assembly
- 15. Video Encoder
- 16. Media converter
- 17. Closed circuit television camera
- 18. Punch blocks

19. Closed circuit television cabinet
20. Splice enclosure
21. Fiber distribution unit
22. BBS Cabinet
23. Batteries for BBS
24. TMS cabinet
25. Video Image Sensor assemblies (VIS)
26. Video Detection Units (VDU)
27. Flat Panel Video display
28. Communication card
29. Extension modules for VDU
30. HUB Cabinet
31. VIVDS Training
32. UPS

Replace "Reserved" in section 86-1.06B with:

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, shown and located within the project limits must 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, the Contractor must provide for temporary or portable TMS elements. The Contractor must receive authorization 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 must 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 not shown 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 must obtain authorization 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 must 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, must 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, the Contractor must provide provisions for temporary or portable detection operations. The Contractor must receive authorization on the type of detection and installation before installing the temporary or portable detection.

If existing TMS elements shown 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 must 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, must be repaired or replaced, at the Contractor's expense, within 24 hours. For a structure-related elements, the Contractor must install temporary or portable TMS elements within 24 hours. For nonstructure-related TMS elements, the Engineer may authorize 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 must install new fiber optic cables from an original splice point or termination to an original splice point or termination, unless otherwise authorized. Fiber optic cable must 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 must 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 must demonstrate that repaired or replaced elements operate in a manner equal to or better than the replaced equipment. If the Contractor fails to perform required repairs or replacement work, the Department may perform the repair or replacement work and the cost will be deducted from monies due to the Contractor.

A TMS element must 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 must 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 must 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 must be repaired at the Contractor's expense.

The Engineer will authorize 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 must be new and of equal or better quality than the existing TMS elements.

If no electrical work exists on the project and no TMS elements are identified within the project limits, the pre-construction operational status check is change order work.

Furnishing and installing temporary or portable TMS elements that are not shown, but are required when an existing TMS element becomes nonoperational or off line due to construction activities, is change order work.

Furnishing and installing temporary or portable TMS elements and replacing TMS elements that are not shown nor identified during the pre-construction operational status check and were damaged by construction activities is change order work.

If the Contractor is required to submit provisions for the replacement of TMS elements that were not identified, submitting the provisions is change order work.

Add to section 86-2.04A:

The sign mounting hardware must be installed at the locations shown.

Install non-illuminated street name signs on signal mast arms using a minimum 3/4 by 0.020-inch round edge stainless steel strap and saddle bracket. Wrap the strap at least twice around the mast arm, tighten, and secure with a 3/4-inch stainless strap seal. Level the sign panel and tighten the hardware securely.

Set the Type 1 standards with the handhole on the downstream side of the pole in relation to traffic or as shown.

Add to section 86-2.05A:

Conduit installed underground must be Type 3.

Add to section 86-2.05C:

If Type 3 conduit is placed in a trench, not in the pavement or under concrete sidewalk, after the bedding material is placed and the conduit is installed, backfill the trench to not less than 4 inches above the conduit with minor concrete under section 90-2, except the concrete must contain not less than 421 pounds of cementitious material per cubic yard. Backfill the remaining trench to finished grade with backfill material.

After conductors have been installed, the ends of the conduits must be sealed with an authorized type of sealing compound.

The final 2 feet of conduit entering a pull box in a reinforced concrete structure may be Type 4.

Add to section 86-2.05:

86-2.05F MULTIDUCT CONDUIT SYSTEM

86-2.05F(1) General

86-2.05F(1)(a) Summary

This work applies when multiduct conduit system (MDCS) is shown.

Multiduct conduit system must use high density polyethylene conduits at underground installations and fiberglass conduit at structure installations.

The size and quantity of conduits are shown.

Multiduct conduit system trench and backfill requirements must be as shown and as specified in the special provisions.

86-2.05F(1)(b) Submittals

Not Used

86-2.05F(2) Materials

86-2.05F(2)(a) General

86-2.05F(2)(a)(1) High Density Polyethylene Conduit

86-2.05F(2)(a)(1)(i) General

High density polyethylene conduit must be suitable for the "Air Blown Method" described in the special provisions.

On arrival at the site, conduit with damage in excess of 10 percent of the conduit wall thickness may be rejected by the Engineer. Conduit with damage outside the manufacturer's recommendations for usable conduit may also be rejected by the Engineer. Conduit sections may be repaired if approved by the Engineer. Replacement or repair of rejected conduit is at your expense.

86-2.05F(2)(a)(1)(ii) Materials

High density polyethylene (HDPE) conduit must be a minimum of Schedule 40 and comply with ASTM F2160.

High density polyethylene conduit color must be consistent for this project: solid orange or black with orange colored stripe. Orange colored stripe must consist of not less than 2 stripes, with longitudinal orientation, evenly spaced.

Ultraviolet stabilizer must be Cb (for black conduit) and E (per ASTM F2160, for orange conduit).

86-2.05F(2)(a)(1)(iii) Construction

Conduit must be joined by heat fusion (includes electrofusion) methods recommended by the conduit manufacturer, and with equipment approved for the purpose. Heat fusion must be performed by conduit manufacturer certified or authorized personnel. Demonstrate a minimum of 2 test fusions, by each fusion operator, to the Engineer prior to performing fusion operations on conduit to be installed.

In addition to the conduit installation methods for Type 3 Conduit, as described in section 86 and in the special provisions, high density polyethylene conduit may be installed by Horizontal Directional Drilling (HDD) (per ASTM F1962 "Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacle, Including River Crossings") or "Directional Boring Method" as described in the special provisions. Where there is a difference or conflict between requirements, the special provisions for "Directional Boring Method" applies.

86-2.05F(2)(a)(2) Fiberglass Communication Conduit**86-2.05F(2)(a)(2)(i) General**

Use fiberglass conduit where communication conduit is shown installed on bridges.

Purchase all fiberglass conduit and other fiberglass conduit system components from the same manufacturer to ensure component to component compatibility.

86-2.05F(2)(a)(2)(ii) Materials

Conduit must be continuously marked with clear, distinctive and permanent markings at intervals not greater than 10 feet. The marking must be in a contrasting color to the conduit color. The height of the marking must be approximately 0.1 inch or larger. Conduit marking information must include, as a minimum, the following information:

1. Nominal Size
2. Schedule
3. Manufacturer Name and Product/Model Number
4. Material Code
5. Plant Identification
6. Production Date
7. Cell Classification

All fiberglass conduit components must be free of defects including delaminations, foreign inclusions, etc. All fiberglass conduit components must be nominally uniform in color, density, and physical properties. Fiberglass conduit must be straight and the ends must be cut square and true.

Fiberglass conduit must be manufactured in nominal 20-foot minimum lengths.

Fiberglass conduit components must include compatible fittings, adapters, expansion joints, and factory bends at nominal radii of 24-inches and 36-inches.

All materials must be manufactured for use at temperatures from -40 to 230°F. All fiberglass conduit components must be manufactured using a homogeneously dispersed UV inhibitor. When exposed to direct diurnal sunlight, the UV inhibitor must prevent the degradation of all physical material properties, except for surface cosmetic appearance. Materials must contain no halogens above trace levels and must be fire resistant.

Fiberglass conduit and components must comply with the specifications in ANSI/NEMA Standards Publication TC 14.

The minimum impact resistance must meet UL 1684A or NEMA TC2002 when tested in accordance with ASTM D2444

For stiffness, the deflection of the inside diameter must not exceed 5 percent when tested per ASTM D 2412.

86-2.05F(2)(a)(2)(iii) Construction

Joints must be watertight and withstand a minimum 1000 lbs of pullout tension.

Wrapping tape must be applied to pipe in contact with the earth or concrete and must be a pressure sensitive polyvinyl chloride or polyethylene tape with a minimum thickness of 0.05 inches.

86-2.05F(2)(a)(3) Sealing Plug

86-2.05F(2)(a)(3)(i) General

Except as otherwise noted, multiduct conduit system must have their ends sealed with commercial preformed plugs which prevent the passage of gas, dust and water into the multiduct conduit system.

Plugs for sealing conduit, conductor or cable must be the split type that permits installation or removal without removing conductors or cables.

Sealing plugs must be removable and reusable.

86-2.05F(2)(a)(3)(ii) Materials

Sealing plugs that seal MDCS (4-inch) must seal the conduit and all enclosed conduits simultaneously with one self contained assembly having an adjustable resilient filler of neoprene or silicone rubber clamped between backing ends and compressed with stainless steel hardware.

Sealing plugs must be capable of withstanding a pressure of 5 psi.

A sealing plug that seals an empty conduit must have an eye or other type of capturing device (on the side of the plug that enters the conduit) to attach onto the pull rope so the pull rope will be easily accessible when the plug is removed.

86-2.05F(2)(a)(3)(iii) Construction

Sealing plugs that seal the 1-inch and 1 1/4 inch conduits of MDCS must seal each conduit individually with appropriate sizes and configuration to accommodate either empty conduit or those containing cable. Suitable sealing between the varying size cables and the plugs must be provided by inserting split neoprene or silicone adapting sleeves, used singularly or in multiples, within the body of the plugs, or an equivalent method approved by the Engineer.

86-2.05F(2)(a)(4) Tracer Wire

86-2.05F(2)(a)(4)(i) General

Tracer wire must be installed in communication conduits containing fiber optic cable inside a MDCS conduit, except when "Directional Boring Method" requires attaching tracer wire to conduit.

86-2.05F(2)(a)(4)(ii) Materials

Tracer wire must be No. 12 minimum solid copper conductor with yellow or orange Type TW, THW, RHW, or USE insulation. A minimum of 3 feet slack must be extended into each communication pull box and fiber optic vault from each direction.

86-2.05F(2)(a)(4)(iii) Construction

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 only in pull boxes or vaults. Splices must conform to Section 86-2.09, "Wiring," of the Standard Specifications.

Verify continuity of the tracer wire after installation. Provide the Engineer with a list of conduit installations where continuity has been verified. Include the following information: conduit identification or location, verification date, and who verified by.

86-2.05F(2)(a)(5) Warning Tape

86-2.05F(2)(a)(5)(i) General

Warning tape must be installed in the trench over new MDCS conduits as shown.

86-2.05F(2)(a)(5)(ii) Materials

Warning tape must not delaminate when it is wet. It must be resistant to insects, acid, alkaline and other corrosive elements in the soil.

The warning tape must have:

Description	Parameter
Thickness	Not less than 4 mil thick
Width	Not less than 3 inches or greater than 6 inches
Material	Pigmented polyolefin film
Tensile strength of material	Minimum of 2700 psi
Elongation	Minimum of 500 percent elongation before breakage
Black Printed Message Text height	0.75 inch to 1 inch
Message background color	Bright orange color background
Message durability	Rated to last the service life of the tape
Message statement	CAUTION: BURIED FIBER OPTIC CABLE - CALTRANS (619) 688-6670,
Message spacing intervals	Approximately 36 inch

86-2.05F(2)(a)(5)(iii) Construction

The printed warning must not be removed by the normal handling and burial of the tape.

86-2.05F(3) Construction

Clean new MDCS conduits with a mandrel or cylindrical soft bristled brush and blow out with compressed air until all foreign material is removed immediately prior to sealing empty conduits or installing cables. Clean conduits in the presence of the Engineer. Seal the ends of MDCS conduits with sealing plugs as specified in the special provisions.

86-2.05F(4) Payment

Not Used

Replace the 3rd paragraph in section 86-2.06A(2) of the RSS for section 86-2.06 with:

In a ground or sidewalk area, embed the bottom of a pull box in crushed rock.

Replace "Reserved" in section 86-2.06B of the RSS for section 86-2.06 with:

86-2.06B(1) General

86-2.06B(1)(a) Summary

Section 86-2.06B includes specifications for installing non-traffic-rated pull boxes.

86-2.06B(1)(b) Submittals

Before shipping pull boxes to the job site, submit a list of materials used to fabricate the pull boxes to METS. Include:

1. Contract number
2. Manufacturer's name
3. Manufacturer's installation instructions
4. Your contact information

Submit reports for pull boxes from an NRTL-accredited laboratory.

Before installing a pull box and cover, submit the manufacturer's replacement warranty for them.

86-2.06B(1)(c) Quality Control and Assurance

86-2.06B(1)(c)(i) Functional Testing

The pull box and cover must be tested under ANSI/SCTE 77, "Specification for Underground Enclosure Integrity."

86-2.06B(1)(c)(ii) Warranty

Provide a 2-year manufacturer's replacement warranty for the pull box and cover. The warranty period starts on the date of Contract acceptance.

Deliver replacement parts within 5 business days after you receive notification of a failed pull box, cover, or both to the Department's Maintenance Electrical Shop at:

Caltrans Escondido Maintenance Station,
1780 W. Mission Avenue, Escondido, CA,
Telephone (760) 746-2947,

86-2.06B(2) Materials

The pull box and cover must comply with ANSI/SCTE 77, "Specification for Underground Enclosure Integrity," for tier 22 load rating and must be gray or brown.

Each pull box cover must have an electronic marker cast inside.

A pull box extension must be made of the same material as the pull box and attached to the box to maintain the minimum combined depths.

Include recesses for a hanger if a transformer or other device must be placed in a pull box.

The bolts, nuts, and washers must be a captive design.

The captive bolt must be capable of withstanding a torque from 55 to 60 ft-lb and a minimum pull-out strength of 750 lb. Perform the test with the cover in place and the bolts torqued. The pull box and cover must not be damaged while performing the test.

Hardware must be stainless steel with 18 percent chromium and 8 percent nickel content.

Galvanize ferrous metal parts under section 75-1.05.

The manufacturer's instructions must include:

1. Quantity and size of entries that can be made without degrading the strength of the pull box below the tier 22 load rating
2. Locations where side entries cannot be made
3. Acceptable method for creating the entry

The tier 22 load rating must be labeled or stenciled by the manufacturer on the inside and outside of the pull box and on the underside of the cover.

86-2.06B(3) Construction

Do not install a pull box in curb ramps or driveways.

A pull box for a post or a pole standard must be located within 5 feet of the standard. Place the pull box adjacent to the back of the curb or edge of the shoulder. If this is impractical, place the pull box in a suitable, protected, and accessible location.

Add to section 86-2.06:

86-2.065 FIBER OPTIC VAULT

86-2.065A General

This work applies when fiber optic vault is shown.

You must not install additional fiber optic vaults over those shown without the Engineer’s written approval.

86-2.065A(1) Summary

Fiber optic vault, cover and extensions must be of the sizes and details shown.

Fiber optic vaults and covers must be rated for AASHTO HS 20-44 loads.

Hanger assemblies must consist of not less than 3 hangers evenly distributed. Hangers must be made of a non-corroding material and be free of any sharp edges. Hanger assembly must be provided for a minimum of eight fiber optic cables and be securely fastened to the side wall with the slack fiber optic cable neatly coiled.

86-2.065B Materials

Fiber optic vault must be precast of non-PCC material. Non-PCC material must be resistant to fire , chemicals and ultraviolet exposure. The non-PCC material must show no appreciable change in physical properties with exposure to the weather. Non-PCC material must be dense and free of voids or porosity.

Covers must be the non-skid type. Cover marking must be "CALTRANS FIBER OPTICS" on each cover. Each cover must have inset lifting pull slots. Cover hold down bolts or cap screws and nuts must be of brass, stainless steel, or other non-corroding metal material.

86-2.065C Construction

A reinforced concrete encasement ring must be poured around the collar of the fiber optic vault as shown. The concrete for encasement ring must contain not less than 548 pounds per cubic yard.

Add to section 86-2.08A:

Wrap conductors around the projecting end of conduit in pull boxes as shown. Secure conductors and cables to the projecting end of the conduit in pull boxes.

Replace the table in the 2nd paragraph of section 86-2.08C with:

Insulation Thickness

Insulation type	Conductor size	Insulation thickness (mils)
USE, RHH, or RHW	No. 14 to No. 10	45
	No. 8 to No. 2	60
THW or TW	No. 14 to No. 10	30
	No. 8	45
	No. 6 to No. 2	60

Replace the 1st sentence of the 1st paragraph of section 86-2.08E with:

Signal interconnect cable must be the 6-pair type with stranded tinned copper no. 20 conductors.

Add to section 86-2.08:

86-2.08F CATEGORY 5E CABLE

86-2.08F(1) General

86-2.08F(1)(a) Summary

Category 5E cable must be the unshielded, outdoor rated, non-gel filled type, and must meet the requirements of TIA/EIA 568, Category 5E Cable.

86-2.08F(1)(b) Definitions

Not Used

86-2.08F(1)(c) Submittals

Not used

86-2.08F(1)(d) Quality Control and Assurance

Category 5E Certified installations are required for installed lengths of 328 feet or less of finished cable.

Installed lengths of Category 5E cable must not exceed 328 feet of finished cable. All installations must be certified installations.

86-2.08F(2) Materials

Category 5E cable must meet the following:

1. The cable must contain 8 conductors, each of which must be No. 24 , minimum, solid bare copper conductors. Each conductor must be insulated with polyolefin, polyethylene, polyvinyl chloride or fluorinated ethylene propylene material.
2. The cable jacket must be rated for a minimum of 300 V and 140°F and must be polyvinyl chloride, polyethylene, polyolefin or fluorinated ethylene propylene. The jacket must be black, gray, or blue. The jacket must be marked as required by NEMA. The jacket must be marked at intervals of not more than 3 feet with the cable identification: manufacturer's name, product identification, number of conductors and conductor size, and voltage and temperature ratings. Cable length markings may be sequentially alternated with the cable identification markings at not more than every other interval.
3. The finished outside diameter of the cable must not exceed 1/2-inch.

86-2.08F(3) Construction

The cable run between components must be continuous without splices. A minimum of 3 feet of slack must be provided at each pull box, junction box or vault, and a minimum of 9 feet at each cabinet.

The ends of category 5E cable terminating at controller and telephone demarcation cabinets must be terminated with Type 110 punch down blocks.

86-2.08F(4) Payment

Not Used

Add to section 86-2.08:

86-2.08G AIR BLOWN METHOD

86-2.08G(1) General

You may install cable into conduit, ducts or subducts using an "Air Blown Method".

86-2.08G(1)(a) Summary

This work includes installing cable into conduit, ducts or subducts with a method that uses a mechanical device combined with a high speed flow of compressed air.

86-2.08G(1)(b) Definitions

Not Used

86-2.08G(1)(c) Submittals

Submit information on the proposed "Air Blown Method" to the Engineer.

Information submittals must include the following:

1. Project description.
2. List or plan sheet marked to identify the conduits and cables involved
3. Equipment description and specifications.
4. Manufacturer's test data covering the performance of the equipment and cable stress in a typical installation using cable equivalent to cable to be installed on this project.
5. User/Installer Manual for the equipment and installation procedures.

Within 30 days after the approval of the contract, submit 2 copies of the proposed "Air Blown Method" to the Engineer.

Allow 7 days for the Engineer to review the proposed "Air Blown Method".

If the Engineer requires revisions, submit a revised "Air Blown Method" within 5 days of receipt of the Engineer's comments and allow 5 days for the Engineer to review. If agreed to by the Engineer, revisions may be included as attachments in the resubmittal. The Engineer may conditionally approve, in writing, resubmittals that include revisions submitted as attachments, in order to allow construction activities to proceed.

Upon the Engineer's approval of the resubmittal, submit 2 copies of the final document (with approved revisions incorporated) to the Engineer.

86-2.08G(1)(d) Quality Control and Assurance

86-2.08G(1)(d)(1) General

The submitted "Air Blown Method" must not be used until it has been approved in writing by the Engineer.

86-2.08G(2) Materials

86-2.08G(2)(a) General

86-2.08G(2)(a)(1) Physical and Mechanical Requirements

The cable installation equipment must also have, at minimum, the following features:

1. Controls to regulate the flow rate of compressed air entering the conduit, duct or subduct, and any hydraulic or pneumatic pressure applied to the cable.
2. Safety shutoff valves to disable the system in the event of sudden changes in pneumatic or hydraulic pressure.
3. Measuring device to determine the speed of the cable during installation and the length of the cable installed.

86-2.08G(3) Construction

Install cable without exceeding the cable manufacturers' tensile and compressive strength ratings.

Use the mechanical device to provide a pushing force on the cable into the conduit.

86-2.08G(4) Payment

Not Used

Replace the 1st paragraph of section 86-2.09E with:

Splices must be insulated by "Heat-shrink tubing."

Delete the 8th paragraph of section 86-2.09E.

Add to section 86-2.08:

86-2.08H FIBER OPTIC COMMUNICATION CABLE PLANT

86-2.08H(1) General

This work applies when fiber optic communication cable plant is shown.

86-2.08H(1)(a) Summary

Fiber optic communication cable plant consists of installing and testing fiber optic outside plant cable, fiber optic splice enclosure, splice tray, passive cable assemblies and components, and system verification, as shown and in the special provisions

86-2.08H(1)(b) Definitions

Breakout. - The cable "breakout" is produced by; (1) removing the jacket just beyond the last tie-wrap point, (2) exposing 3 to 6 feet of the cable buffers, aramid strength yarn and central fiberglass strength member, and (3) cutting the aramid yarn, central strength member and the buffer tubes to expose the individual glass fibers for splicing or connection to the appropriate device.

Connector. - A mechanical device used to align and join two fibers together to provide a means for attaching to and decoupling from a transmitter, receiver, or another fiber (patch panel).

Connectorized. - The termination point of a fiber after connectors have been affixed.

Couplers. - Devices which mate fiber optic connectors to facilitate the transition of optical light signals from one connector into another. They are normally located within FDFs mounted in panels. They may also be used unmounted, to join two simplex fiber runs.

Fiber Distribution Frame (FDF). - A rack mounted system that consists of a standard equipment rack, fiber routing guides, horizontal jumper troughs and Fiber Distribution Unit (FDU).

The FDF serves as the "home" for the passive fiber optic components from cable breakout, for connection by jumpers, to the equipment.

Fiber Distribution Unit (FDU). - An enclosure or rack-mountable unit containing both a patch panel with couplers and a splice tray(s). The unit's patch panel and splice trays may be integrated or separated by a partition.

FO. - Fiber optic.

FOIP. - Fiber optic inside plant cable.

FOP. - Fiber optic outside plant cable.

FOTP. - Fiber optic test procedure(s) as defined by EIA/TIA standards.

Jumper. - A short fiber optic cable that has connectors installed on both ends, and is typically used to join two CMH couplers or a CMH to active electronic components.

Light Source. - Portable fiber optic test equipment that, in conjunction with a power meter, is used to perform end-to-end attenuation testing. It contains a stabilized light source operating at the designed wavelength of the system under test. It also couples light from the source into the fiber to be received at the far end by the receiver.

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 from a FO transmitter to a video multiplexer (MUX).

Link Loss Budget. - A calculation of the overall permissible attenuation from the fiber optic transmitter (source) to the fiber optic receiver (detector).

Loose Tube Cable. - Type of cable construction in which fibers are placed in filled buffer tubes to isolate them from outside forces (stress). A flooding compound is applied to the interstitial cable core to prevent water migration and penetration. This type of cable is primarily for outdoor applications.

Optical Time Domain Reflectometer (OTDR). - Fiber optic test equipment (similar in appearance to an oscilloscope) that is used to measure the total amount of power loss between two 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 the losses that are attributed to each component or defect in the fiber, splices and connectors.

Patchcord. - A short jumper used to join two Connector Module Housing (CMH) couplers and or a CMH and an active device (electronics).

Pigtail. - A short length of fiber optical cable permanently connectorized on only one end to a source, detector, or other fiber optic device. All pigtails must be tight buffer cable.

Power Meter. - Portable fiber optic test equipment that, in conjunction with a light source, is used to perform end-to-end attenuation testing. It contains 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 that is not connected to any active device and may or may not have splices per the design.

Splice. - The permanent joining of fiber ends to identical or similar fibers.

Splice Enclosure. - A environmentally sealed container used to organize and protect splice trays. The container allows splitting or routing of fiber cables from multiple locations. It is normally installed in a splice vault.

Splice Module Housing (SMH). - A unit that stores splice trays as well as pigtails and short cable lengths. The unit allows splitting or routing of fiber cables to or from multiple locations.

Splice Tray. - A container used to organize and protect spliced fibers.

Splice Vault. - An underground container used to house excess cable and/or splice enclosures.

Storage Cabinet. - Designed for holding excess cable slack for protection. The storage cabinet allows the user flexibility in equipment location and the ability to pull cable back for resplicing.

Tight Buffered. - Type of non-breakout cable construction where each glass fiber is tightly buffered (directly coated) with a protective thermoplastic coating to 900 μm (compared to 250 μm for loose tube fibers).

86-2.08H(1)(c) Submittals

A minimum of 10 working days before the scheduled delivery of the fiber optic outside plant cable to the project site, submit documentation of detailed factory test procedures and results for the Engineer's review and approval.

The procedures must identify the cable tests performed and conducted. Included in the test procedures must be the model, manufacturer, configuration, calibration and alignment and operating procedures for all proposed test equipment.

Submit two copies of the manufacturer's cable installation procedures and technical support information to the Engineer at least two weeks before the scheduled delivery of the cable to the project site.

86-2.08H(1)(d) Quality Control and Assurance

Testing must include the tests on elements of the passive fiber optic components: (1) at the factory, (2) after delivery to the project site but prior to installation, (3) after installation and (4) during final system testing. Test the active components after installation.

You must provide all personnel, equipment, instrumentation and materials necessary to perform all field testing. Notify the Engineer two working days prior to all field tests. The notification must include the exact location or portion of the system to be tested.

86-2.08H(1)(d)(i) Factory Testing

You must provide the documentation from the original cable manufacturer for the factory testing and of compliance with the fiber specifications as listed in the Fiber Characteristics Table. Before shipment, but while on the shipping reel, 100 percent of all fibers must be tested for attenuation. Test results must be recorded and dated. Copies of the results must be (1) maintained on file by the manufacturer with a file identification number for a minimum of seven years, (2) attached to the cable reel in a waterproof pouch, and (3) You must provide a copy to the Engineer. Copies of the test results must also be filed with the copy accompanying the shipping reel in a separate weather proof envelope.

86-2.08H(1)(d)(ii) Arrival on Site

Physically inspect the cable and reel on delivery.

Measure the attenuation for 100 percent of the fibers to confirm that the cable meets requirements. Singlemode fibers must be tested at 1310 nm and 1550 nm after arrival on site. Attenuation readings in one direction must be recorded on the cable data sheet.

Test results must be recorded, dated, compared to the detailed factory test results documents, and submitted to the Engineer.

Attenuation deviations from the shipping records of greater than 5 percent must be brought to the attention of the Engineer. The cable must not be installed until completion of this test sequence and the Engineer provides written approval.

The failure of any single fiber in the cable to comply with the special provisions is cause for rejection of the entire reel.

If the test results are unsatisfactory, the reel of fiber optic cable must be considered unacceptable and all records corresponding to that reel of cable must be marked accordingly. Replace the unsatisfactory reels of cable with new reels of cable at your expense. Test the new reels of cable to demonstrate acceptability. Submit copies of the test results to the Engineer.

Allow 5 working days for the Engineer to review the "arrival on site test" results and notify you of the results of the review.

86-2.08H(1)(d)(iii) After Cable Installation

After the fiber optic cable has been pulled but before breakout and termination, test 100 percent of all the fibers with an OTDR for attenuation.

Singlemode fibers must be tested at 1310 nm and 1550 nm after cable installation. Attenuation readings for each direction must be recorded on the cable data sheet.

Test results must be recorded, dated, and compared to the detailed test procedures documents at the factory. Submit copies of traces and test results to the Engineer.

If the OTDR test results are unsatisfactory, the F/O cable segment will be unacceptable. Replace the unsatisfactory segment of cable with a new segment, without additional splices, at the your expense. Test the new segment of cable to demonstrate acceptability. Submit copies of the test results to the Engineer.

Allow 10 working days for the Engineer to review the "after cable installation test" results and notify you of the results of the review.

86-2.08H(1)(d)(iv) Outdoor Splices

At the conclusion of all outdoor splices at one location, and before they are enclosed and sealed, test all splices with the OTDR, in both directions. Splices in segments must be tested at 1310 nm and at 1550 nm. Individual fusion splice losses must not exceed 0.07 dB. Measurement results must be recorded, dated, validated by the OTDR trace printout and filed with the records of the respective cable runs. Submit copies of traces and test results to the Engineer. If the OTDR test results are unsatisfactory, the splice is unacceptable. Replace the unsatisfactory splice at the your expense. Test the new splice to demonstrate acceptability. Submit copies of the test results to the Engineer.

86-2.08H(1)(d)(v) Passive Interconnect Package Testing and Documentation

All the components of the passive interconnect package (FDUs, pigtails, jumpers, couplers and splice trays as shown and in the special provisions) must comprise a unit from a manufacturer who is regularly engaged in the production of the fiber optic components.

In developing the passive interconnect package, each SC termination (pigtail or jumper) must be tested for insertion attenuation loss with the use of an optical power meter and light source. In addition, all singlemode terminations must be tested for return reflection loss. These values must meet the loss requirements specified earlier and must be recorded on a tag attached to the pigtail or jumper.

Once assembly is complete, the manufacturer must visually verify that all tagging, including loss values, is complete. Then as a final quality control measure, the manufacturer must do an "end to end" optical power meter/light source test from pigtail end to jumper lead end to assure continuity and overall attenuation loss values.

The final test results must be recorded, along with previous individual component values, on a special form assigned to each FDU. The completed form must be dated and signed by the Manufacturer's Quality Control supervisor. One copy of this form will be attached in a plastic envelope to the assembled FDU unit. Copies will be provided separately to you and to the Engineer, and must be also be maintained on file by the manufacturer or supplier.

86-2.08H(1)(d)(vi) System Verification at Completion

OTDR Testing. - Once the passive cabling system has been installed and is ready for activation, test 100 percent of the fiber links with the OTDR for attenuation. Print out must include at least link number, fiber color, buffer color and cable number. Test results must be recorded, dated, compared and filed with previous copies. Submit a hard copy printout and a electronic copy of the traces and test results along with a licensed copy of the associated software on a Windows XP PC compatible CD to the Engineer. If the OTDR test results are unsatisfactory, replace the link at your expense. Test the new link to demonstrate acceptability. Submit copies of the test results to the Engineer.

Power Meter and Light Source. - At the conclusion of the final OTDR testing, test 100 percent of all fiber links 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 the OTDR tests. Conduct these tests in both directions. Test results must be recorded, compared and proven to be within the design link loss budgets, and filed with the other recordings of the same links. Submit copies of the test results to the Engineer.

Link Loss Budget Worksheet. - The Link Loss Budget Worksheet shown in Appendix A must be completed for 100 percent of all links in the fiber optic system, using the data gathered during cable verification. Include the completed worksheets as part of the system documentation.

Test Failures. - If the link loss measured from the power meter and light source exceeds the calculated link loss, or the actual location of the fiber ends does not agree with the expected location of the fiber ends (as would occur with a broken fiber), the fiber optic link will not be accepted. Replace the unsatisfactory segments of cable or splices with a new segment of cable or splice at your expense. The OTDR testing, power meter and light source testing and Link Loss Budget Worksheet must be completed for the repaired link to determine acceptability. Submit copies of the test results to the Engineer. The removal and replacement of a segment of cable must be interpreted as the removal and replacement of a single contiguous length of cable connecting two splices, two connectors or one splice and one connector. The removal of only the small section containing the failure and therefore introducing new unplanned splices, will not be allowed.

APPENDIX A

Link Loss Budget Worksheet

Contract No. _____ Contractor: _____

Approved by Caltrans: _____

Date: _____ Operator: _____

Link Number: _____ Fiber Color: _____

Buffer Color: _____ Cable No.: _____

Test Wavelength (Circle one): 1310 1550

Expected Location of fiber ends: End 1: _____ End 2: _____

OTDR Test Results: Forward Loss: _____ dB Reverse Loss: _____ dB Average Loss: _____ dB		1A 1B 1C
Power Meter and Light Source Test Results: Forward Loss: _____ dB Reverse Loss: _____ dB Average Loss [(2A + 2B)/2]: _____		2A 2B 2C
Calculated Fiber Loss: Length of the link (from OTDR): _____ km Allowed loss per km of fiber: 0.4 dB/km Total Allowed Loss due to the fiber (3A * 3B): _____ dB		3A 3B 3C
Calculated Splice Loss: Number of Splices in the Link: _____ Allowed Link Loss per Splice: 0.07 dB Total Allowed Loss due to Splices (4A * 4B): _____ dB		4A 4B 4C
Calculated Link Loss: Connector Loss: 0.9 dB Total Link Loss (5A + 3C + 4C): _____ dB		5A 5B
Cable Verification: Compare Power Meter Average Loss to Calculated Link Loss (2C - 5B): _____ dB If the value of 6A is greater than zero, the link has failed the Test. See "Test Failures" in these special provisions.		6A

 To Be Completed by Caltrans:

Resident Engineer's Signature: _____

Cable Link Accepted: _____

86-2.08H(2) Materials

86-2.08H(2)(a) Fiber Optic Outside Plant Cable

86-2.08H(2)(a)(i) General

Each fiber optic outside plant cable (FOP) for this project must be all dielectric, non-gel water blocking materials, duct type, with loose buffer tubes and must conform to the special provisions. Cables with singlemode fibers must contain singlemode (SM) dual-window (1310 nm and 1550 nm) fibers in the quantities shown below and on the plans.

Quantity	Cable
12	SMFO
144	SMFO

The optical fibers must be contained within loose buffer tubes. The loose buffer tubes must be stranded around an all dielectric central member. Aramid yarn or fiberglass must be used as a primary strength member, and a polyethylene outside jacket must provide for overall protection.

All fiber optic (F/O) cable on this project must be from the same manufacturer, who is regularly engaged in the production of this material.

The cable must comply with all the requirements of RUS-Chapter XVII, Title 7, Section 1755.900 and as specified in the special provisions.

86-2.08H(2)(a)(ii) Materials

Each optical fiber must be glass and consist of a doped silica core surrounded by concentric silica cladding. All fibers in the buffer tube must be usable fibers, and must be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical, and environmental requirements of these specifications. The required fiber grade SM must reflect the maximum individual fiber attenuation, to guarantee the required performance of each and every fiber in the cable. The coating must be a dual layered, UV cured acrylate. The coating must be mechanically or chemically strippable without damaging the fiber. The cable must comply with the optical and mechanical requirements over an operating temperature range from -40 to +70 °C. The cable 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." The change in attenuation at extreme operational temperatures (from -40 to +70 °C) for singlemode fiber must not be greater than 0.20 dB/km, with 80 percent of the measured values no greater than 0.10 dB/km. The singlemode fiber measurement is made at 1550 nm. For all fibers the attenuation specification must be a maximum attenuation for each fiber over the entire operating temperature range of the cable.

Singlemode fibers within the finished cable must meet the requirements in the following table:

Parameter	Singlemode
Type	Step Index
Core diameter	8.3 μm (nominal)
Cladding diameter	125 μm \pm 1.0 μm
Core to Cladding Offset	\leq 1.0 μm
Coating Diameter	250 μm \pm 15 μm
Cladding Non-circularity defined as: [1-(Min cladding Dia \div Max cladding Dia.) \times 100]	\leq 2.0 percent
Proof/Tensile Test	
Attenuation: (-40 to +70 °C) @1310 nm @1550 nm	\leq 0.4 dB/km \leq 0.3 dB/km
Attenuation at the Water Peak	\leq 2.1 dB/km @ 1383 \pm 3 nm
Chromatic Dispersion: Zero Dispersion Wavelength Zero Dispersion Slope	1301.5 to 1321.5 nm \leq 0.092 ps/(nm ² *km)
Maximum Dispersion:	\leq 3.3 ps/(nm*km) for 1285 – 1330 nm $<$ 18 ps/(nm*km) for 1550 nm
Cut-Off Wavelength	$<$ 1260 nm
Mode Field Diameter (Petermann II)	9.3 \pm 0.5 μm at 1300 nm 10.5 \pm 1.0 μm at 1550 nm

86-2.08H(2)(a)(iii) Fiber Color Coding

Optical fibers must be distinguishable from others in the same buffer 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)

The colors must be targeted in accordance with the Munsell color shades and must meet EIA/TIA-598 "Color Coding of Fiber Optic Cables."

Buffer tubes containing fibers must also be color coded with distinct and recognizable colors according to the same table listed above for fibers.

The color formulation must be compatible with the fiber coating and the buffer tube filling compound, and be heat stable. It must not fade or smear or be susceptible to migration and it must not affect the transmission characteristics of the optical fibers and must not cause fibers to stick together.

Submit a manufacturer's sample of fiber optic cable, 10 feet in length, with part numbers and original catalog and documents, to the Engineer.

86-2.08H(2)(a)(iv) Cable Construction

86-2.08H(2)(a)(iv)(a) General

The fiber optic cable must consist of, but not be limited to, the following components:

1. Buffer tubes
2. Central member

3. Filler rods
4. Stranding
5. Core and cable flooding
6. Tensile strength member
7. Ripcord
8. Outer jacket

Buffer Tubes. - Loose buffer tubes must provide clearance between the fibers and the inside of the tube to allow for expansion without constraining the fiber. The fibers must be loose or suspended within the tubes and must not adhere to the inside of the tube. Each buffer tube must contain 6 or 12 fibers.

The loose buffer tubes must be extruded from a material having a coefficient of friction sufficiently low to allow free movement of the fibers. The material must be tough and abrasion resistant to provide mechanical and environmental protection of the fibers, yet designed to permit safe intentional "scoring" and breakout, without damaging or degrading the internal fibers.

Buffer tube must have a non-gel water-blocking material used to prevent water intrusion and migration. The filling compound must be non-toxic and dermatologically safe to exposed skin. It must be chemically and mechanically compatible with all cable components, non-nutritive to fungus, non-hygroscopic and electrically non-conductive. The 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 that will prevent stress on the fibers when the cable jacket is placed under strain, such as the reverse oscillation stranding process.

Central Member. - The central member which functions as an anti-buckling element must be a glass reinforced plastic rod with similar expansion and contraction characteristics as the optical fibers and buffer tubes. A linear overcoat of low density polyethylene must be applied to the central member to achieve the optimum diameter to provide the proper spacing between buffer tubes during stranding.

Filler Rods. - Filler rods may be included in the cable to lend symmetry to the cable cross-section where needed. Filler rods must be solid medium or high density polyethylene. The diameter of filler rods must be the same as the outer diameter of the buffer tubes.

Stranding. - Completed buffer tubes must be stranded around the overcoated central member using stranding methods, lay lengths and positioning such that the cable must meet mechanical, environmental and performance specifications. A polyester binding must be applied over the stranded buffer tubes to hold them in place. Binders must be applied using tension sufficient to secure the buffer tubes to the central member without crushing the buffer tubes. The binders must be non-hygroscopic, non-wicking (or rendered so by the flooding compound), and dielectric with low shrinkage.

Core and Cable Flooding. - The cable core interstices must be filled with a polyolefin based compound to prevent water ingress and migration. The flooding compound must be homogeneous, non-hygroscopic, electrically non-conductive, and non-nutritive to fungus. The compound must also be nontoxic, dermatologically safe and compatible with all other cable components.

Tensile Strength Member. - Tensile strength must be provided by high tensile strength aramid yarns or fiberglass which must be helically stranded evenly around the cable core and must not adhere to other cable components.

Ripcord. - The cable must contain at least one ripcord under the jacket for easy sheath removal.

Outer Jacket. - The jacket 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 40.0 ± 3 mil. Jacketing material must be applied directly over the tensile strength members and flooding compound and must not adhere to the aramid strength material. The polyethylene must contain carbon black to provide ultraviolet light protection and must not promote the growth of fungus.

The jacket or sheath must have clear, distinctive and permanent markings showing the manufacturer's name, the words "Optical Cable", the number of fibers, "SM", year of manufacture, and sequential measurement markings every 3 feet. The actual length of the cable must be within -0/+1 percent of the length marking. The marking must be in a contrasting color to the cable jacket. The height of the marking must be approximately 0.1-inch.

86-2.08H(2)(a)(v) Functional Requirements

The F/O cable must withstand water penetration when tested with a one meter static head or equivalent continuous pressure applied at one end of a 3-foot length of filled cable for one hour. No water must leak through the open cable end. Testing must be done in accordance with ANSI/EIA-455-82 (FOTP-82), "Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable."

A representative sample of cable must be tested in accordance with ANSI/EIA/TIA-455-81A "Compound Flow (Drip) Test for Filled Fiber Optic Cable". The test sample must be prepared in accordance with Method A. No preconditioning period must be conducted. The cable must exhibit no flow (drip or leak) at 70°C as defined in the test method.

Crush resistance of the finished F/O cables must be 220 N/cm applied uniformly over the length of the cable 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 the fibers must be ≤ 0.10 dB at 1550 nm (singlemode) for a cable subjected to this load. The cable must not exhibit any measurable increase in attenuation after removal of load. Testing must be in accordance with EIA-455-41 (FOTP-41), except that the load must be applied at the rate from 0.10 to 0.75 inch per minute and maintained for 10 minutes.

The cable must withstand 25 cycles of mechanical flexing at a rate of 30 ± 1 cycles/minute. The average increase in attenuation for the fibers must be ≤ 0.20 dB at 1550 nm (singlemode) at the completion of the test. Outer cable jacket cracking or splitting observed under 10x magnification constitutes failure. The test must be conducted in accordance with EIA-455-104 (FOTP-104), "Fiber Optic Cable Cyclic Flexing Test," with the sheave diameter a maximum of 20 times the outside diameter of the cable. The cable must be tested in accordance with Test Conditions I and II of (FOTP-104).

The cable must withstand 20 impact cycles. . The average increase in attenuation for the fibers must be ≤ 0.20 dB at 1550 nm (singlemode). The cable jacket must not exhibit evidence of cracking or splitting. The test must be conducted in accordance with EIA-455-25 (FOTP-25), "Impact Testing of Fiber Optic Cables and Cable Assemblies."

The finished cable must withstand a tensile load of 610 pounds without exhibiting an average increase in attenuation of greater than 0.20 dB. The test must be conducted in accordance with EIA-455-33 (FOTP-33), "Fiber Optic Cable Tensile Loading and Bending Test." The load must be applied for one-half hour in Test Condition II of the EIA-455-33 (FOTP-33) procedure.

86-2.08H(2)(a)(vi) Packaging and Shipping Requirements

The completed cable must be packaged for shipment on reels. The cable must be wrapped in a weather and temperature resistant covering. Both ends of the cable must be sealed to prevent the ingress of moisture.

Each end of the cable must be securely fastened to the reel to prevent the cable from coming loose during transit. Ten feet of cable length on each end of the cable must be accessible for testing.

Each cable reel must have a durable weatherproof label or tag showing the manufacturer's name, the cable type, the actual length of cable on the reel, your name, the contract number, and the reel number. A shipping record must also be included in a weatherproof envelope showing the above information and also include the date of manufacture, cable characteristics (size, attenuation, bandwidth, etc.), factory test results, cable identification number and any other pertinent information.

The minimum hub diameter of the reel must be at least thirty times the diameter of the cable. The F/O cable must be in one continuous length per reel with no factory splices in the fiber. Each reel must be marked to indicate the direction the reel should be rolled to prevent loosening of the cable.

86-2.08H(2)(a)(vii) Installation

Installation procedures must conform to the cable manufacturer's procedures for the specific cable being installed. Mechanical aids may be used, provided that a tension measuring device is placed in tension to the end of the cable, and the allowable tension does not exceed 500 lbf or the manufacturer's recommended pulling tension whichever is less. A calibrated break-away feature must be employed to work in tandem with the tension measuring device and limit excessive tension by disengaging when a set tension is exceeded.

When mechanical aids are proposed for use in pulling fiber optic cable, submit information on the proposed methods and the conditions for use. The submittal must conform to the information submittal requirements, including the time frames for review and approval, as described in "Air Blown Method," of the special provisions.

Except when the "Air Blown Method" is used, FO cable must be installed using a cable pulling lubricant recommended by the FO cable or the conduit manufacturer and a non-abrasive pull tape.

Splices must be limited to locations as shown and as directed by the Engineer.

During cable installation, the bend radius must be maintained at not less than twenty times the outside diameter of the cable. The stress relief component must be installed at the entrance to the FDU as recommended by the manufacturer. The cable grips for installing the fiber optic cable must have a ball bearing swivel to prevent the cable from twisting during installation. The final installed bend radius of the fiber optic cable must be no less than ten times the outside diameter of the cable.

FO cable must be installed without splices except where specifically allowed on the plans. If splice locations are not shown, splicing must be limited to one cable splice every 3.5 miles. Any midspan access splice or FDU termination must involve only those fibers being spliced as shown. Cable splices must be located in splice enclosures, installed in splice vaults shown. A minimum of 65 feet of slack must be specified for each F/O cable at each splice vault. A minimum of 50 feet of slack must be provided at each vault without a cable splice. Slack must be divided equally on each side of the F/O splice enclosure.

Only one FO cable must be installed in each conduit unless shown or provided otherwise.

86-2.08H(2)(a)(viii) Labeling

Label fiber optic cables in a permanent and consistent manner. Labels must be made of a material designed for permanent labeling. Labels must be mechanically marked with permanent ink on non-metal type labels, or embossed lettering on metal type labels; hand written labels must not be used. Metal tags must be constructed of stainless steel. Metal tags are required for use on fiber optic cables. Use of non-metal label materials must be only as approved by the Engineer. At vaults and other underground locations, all labels and imprinting must be weatherproof. Affix labels per the manufacturer's recommendations in a manner that will not cause damage to the cable or fiber.

86-2.08H(2)(a)(viii)(a) Cable Identification

Identification used for labeling of the fiber optic cables must be as shown.

86-2.08H(2)(a)(viii)(b) Label Placement

Fiber Optic Cables. - All cables must be labeled at all terminations, even if no connections or splices are made, and at fiber optic vault entrance and exit points (where splicing is required at the vault).

Cable to Cable Splices. - The cable must be labeled at entry to splice enclosure.

Cable to Fiber Distribution Units. - The cable must be labeled at entry to the FDU. Only one cable must be terminated in each FDU. The FDU must be labeled on the face of the FDU. Individual connections must be clearly marked on the face of the FDU in the designated area as directed by the Engineer.

Fibers. - Fiber labels must be placed next to the connectors of the individual fibers.

Jumpers. - Equipment to FDU Jumpers must be labeled as to the equipment type connected and must be labeled at both ends. FDU to FDU jumpers must be labeled with the cable ID-TYPE-START-END information at each end.

86-2.08H(2)(a)(viii) Fiber Optic Splicing

Unless otherwise allowed, FO cable splices must be fusion type. The mean splice loss must not exceed 0.07 dB per splice. The mean splice loss must be obtained by measuring the loss through the splice in both directions and then averaging the resultant values.

The field splices must connect the fibers of the two FO cable lengths together. These splices must be placed in a splice tray and these splice tray(s) must then be placed in the splice enclosure.

Fibers of the same buffer tube, but not being spliced must be placed in a splice tray alongside spliced fibers. Buffer tubes that do not require enclosed fibers to be spliced must not be disturbed and placed in the splice enclosure.

The termination splices must connect the FO cable span ends with pigtails. The termination splices must be placed in a splice tray and the splice tray(s) must then be placed in the fiber distribution unit (FDU). The individual fibers must be looped one full turn within the splice tray to avoid micro bending. A 2-inch minimum bend radius must be maintained during installation and after final assembly in the optical fiber splice tray. Each bare fiber must be individually restrained in a splice tray. The optical fibers in buffer tubes and the placement of the bare optical fibers in the splice tray must be such that there is no discernible tensile force on the optical fiber.

All splices must be protected with a metal reinforced thermal shrink sleeve.

All fiber optic cables must be labeled in the splice tray. Pigtail ends must also be labeled to identify the destination of the fiber.

86-2.08H(2)(b) Fiber Optic Splice Enclosure

The fiber optic field splices must be enclosed in splice enclosures which must be complete with splice organizer trays, brackets, clips, cable ties, and sealant, as needed. The splice enclosure must be suitable for a direct burial or pull box application. Manufacturer's installations must be supplied to the Engineer prior to the installation of any splice enclosures. Location of the splice enclosures must be where a splice is required as shown, designated by the Engineer, or described in the special provisions.

The splice enclosure must conform to the following specifications:

1. Non-filled thermoplastic case
2. Rodent proof, water proof, re-enterable and moisture proof
3. Expandable from 2 cables per end to 8 cables per end by using adapter plates
4. Cable entry ports must accommodate 0.40-inch to 1-inch diameter cables
5. Multiple grounding straps
6. Accommodate up to 8 splice trays
7. Suitable for "butt" or "through" cable entry configurations
8. Place no stress on finished splices within the splice trays

The size of the enclosure must allow all the fibers of the largest fiber optic cable to be spliced to a second cable of the same size, plus 12 additional pigtails. The enclosure must fit into the fiber optic splice vault and must leave sufficient space for routing of the fiber optic communication cables, without exceeding the minimum bending radius of any cable.

All materials in the enclosures must be nonreactive and must not support galvanic cell action.

Adequate splice trays must be specified to splice all fibers of the largest fiber optic cable, plus 12 pigtails.

The enclosure must be sealed using a procedure recommended by the manufacturer that will provide a waterproof environment for the splices. Encapsulant must be injected between the inner and outer enclosures.

Care must be taken at the cable entry points to ensure a tight salt resistant and waterproof seal is made which will not leak upon aging. It is acceptable to have multiple pigtails enter the fiber splice enclosure through one hole as long as all spaces between the cables are adequately sealed.

Bolt the splice enclosure to the side wall of the fiber optic vault.

The fiber optic splice enclosure must be suitable for a temperature range from 32 to 104°F.

Each splice must be individually mounted and mechanically protected in the splice tray.

You must install the fiber splice enclosure in the fiber optic vaults where splicing is required. The fiber optic splice enclosures must be securely fastened to the fiber optic vault or wall using standard hardware as recommended by the enclosure manufacturer.

You must provide all mounting hardware required to securely mount the enclosures.

86-2.08H(2)(c) Splice Tray

Splice trays must accommodate a minimum of 12 fusion splices and must allow for a minimum bend radius of 1.75 inch. Individual fibers must be looped one full turn within the splice tray to allow for future splicing. No stress is to be applied on the fiber when it is located in its final position. Buffer tubes must be secured near the entrance of the splice tray to reduce the chance of an inadvertent tug on the pigtail and damage to the fiber. The splice tray cover must be transparent.

Splice trays in the splice enclosure must conform to the following:

1. Accommodate up to 24 fusion splices
2. Place no stress on completed splices within the tray
3. Accommodate "butt" or "feed through" splicing applications.
4. Stackable with a transparent snap-on hinge cover
5. Buffer tubes securable with channel straps
6. Contain fiber retention strips.
7. Must be able to accommodate a fusion splice with the addition of an alternative splice holder
8. Must be labeled after splicing is completed.

Only one single splice tray may be secured by a bolt through the center of the tray in the fiber termination unit. Multiple trays must be securely held in place as per the manufacturer's recommendation.

86-2.08H(2)(d) Passive Cable Assemblies And Components

The F/O cable assemblies and components must be compatible components, designed for the purpose intended, and manufactured by a company regularly engaged in the production of material for the fiber optic industry. All components or assemblies must be best quality and non-corroding. All components or assemblies of the same type must be from the same manufacturer.

86-2.08H(3) Construction

86-2.08H(3)(a) Fiber Optic Cable Terminations

Fiber optic cable must continue within the conduit to the designated termination point for cable termination. All components must be the size and type required for the specified fiber. Fiber optic cable terminations may take place in several locations such as TOS cabinets and camera sites.

At the FDU, the cable jacket of the fiber optic cable, must be removed exposing the aramid yarn, filler rods, and buffer tubes. The exposed length of the buffer tubes must be at least the length recommended by the FDU manufacturer which allows the tubes to be secured to the splice trays. The remainder of the tubes must be removed to expose sufficient length of the fibers in order to properly install on the splice tray, as described in "Fiber Optic Splicing," in these special provisions

86-2.08H(4) Payment

Not Used

Add to section 86-2.11A:

Circuit breakers must be the cable-in/cable-out type mounted on non-energized clips. All circuit breakers must be mounted vertically with the up position of the handle being the "ON" position.

Each service must be provided with up to 2 main circuit breakers that will disconnect ungrounded service entrance conductors. Where the "Main" circuit breaker consists of 2 circuit breakers as described, each of the circuit breakers must have a minimum interrupting capacity of 10,000 A, rms.

Replace item 9 in the list in the 5th paragraph of section 86-2.11A with:

Circuit breakers used as service disconnect equipment must have a minimum interrupting capacity of 42,000 A, rms, for 120/240 V(ac).

Replace 7th and 8th paragraphs of section 86-2.11A with:

Service equipment enclosures must be the aluminum type.

Replace "Reserved" in section 86-2.11B with:

Electric service (irrigation) must be from the service points to the irrigation controllers (IC) and to the spaces provided in the irrigation controller enclosure cabinets (CEC) for irrigation controllers as shown.

Conductors to irrigation controller enclosure cabinets and irrigation controllers are included in the payment for electric service (irrigation). Conduit and pull boxes to the pull box adjacent to irrigation controller enclosure cabinets are included in the payment for electric service (irrigation).

Replace 1st paragraph of section 86-2.18 with:

Place numbers (with a reflective sheet background) on the equipment as ordered. A typical material reference at an existing location in the field can be confirmed by the Engineer, or the typical materials can be made available for viewing.

Delete 2nd sentence of 3rd paragraph of section 86-2.18.

Add to the 4th paragraph of section 86-2.18:

On electroliers, place the numbers on the side nearest the roadway facing approaching traffic at a height up to 8 feet above the base plate.

Replace the 1st paragraph of section 86-3.02A(1) with:

This work includes installing a battery backup system. Comply with TEES.

Add to section 86-3.02A(2):

Submit the manufacturer's warranty documentation before installing the batteries.

Add to section 86-3.02A(3):

Batteries must have a 5-year manufacturer's warranty against defects in materials and workmanship. The warranty period starts on the date of Contract acceptance. Provide replacement batteries within 5 business days after notification of failed batteries. The Department pays to ship the failed batteries. Deliver replacement batteries to the District Maintenance Electrical Shop at:

Caltrans Escondido Maintenance Station,
1780 W. Mission Avenue, Escondido, CA,
Telephone (760) 746-2947,

Add to section 86-3.02B:

The external cabinet must be capable of housing:

1. 4 batteries
2. Inverter/charger unit
3. Power transfer relay
4. Manually-operated bypass switch
5. Required control panels
6. Wiring and harnesses

Add to section 86-3.02C:

The Department assembles the BBS.

Add to section 86-3.04:

Cabinet must be Model 334L and consist of a housing (B), a mounting cage 1, and the following listed equipment. The equipment must comply with chapter 6 of TEES.

1. Service panel no. 1
2. Power distribution assembly no. 3

3. Input file (1 file)
4. C1 harness
5. Controller and equipment shelves
6. Dual fan assembly with thermostatic control
7. Mechanical armature-type relays
8. Input panel

Notify the Engineer when each 334L cabinet is ready for functional testing. Functional testing will be conducted by the Department.

Each power distribution assembly must include the following equipment:

1. Two duplex NEMA 5-15R controller receptacle (rear mount)
2. One 30 A, 1-pole, 120 V(ac) main circuit breaker
3. Three 15 A, 1-pole, 120 V(ac) circuit breaker
4. One duplex GFCI NEMA 15 A, receptacle (front mount)

Furnish 3 shelves as shown. 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. Arrange shelves as shown. 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.

Furnish 3 terminal blocks as shown. Terminal blocks must comply with Chapter 6 of TEES, except the screw size must be 8-32.

Furnish a maintenance manual or a combined maintenance and operation manual for all controller units, auxiliary equipment, vehicle detector sensor units, control units, and amplifiers. Submit manual when the controllers are delivered for testing or, if ordered by the Engineer, before purchasing. The manual must include the following:

1. Specifications
2. Design characteristics
3. General operation theory
4. Function of all controls
5. Troubleshooting procedure (diagnostic routine)
6. Block circuit diagram
7. Geographical layout of components
8. Schematic diagrams
9. List of replaceable component parts with stock numbers

Replace section 86-4.01D(1)(c)(ii) with:

86-4.01D(1)(c)(ii) 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 Department 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:

Caltrans Escondido Maintenance Station,
1780 W. Mission Avenue, Escondido, CA,
Telephone (760) 746-2947,

Add to section 86-4.01D(2)(a):

LED signal module must be manufactured for 12-inch circular, and arrow sections.

Replace section 86-4.03H with:

86-4.03H LED Countdown Pedestrian Signal Face Modules

86-4.03H(1) General

86-4.03H(1)(a) Summary

Section 86-4.03H includes specifications for installing a LED countdown PSF module into a standard Type A pedestrian signal housing. Comply with TEES.

86-4.03H(1)(b) Definitions

Not Used

86-4.03H(1)(c) Submittals

Before shipping LED countdown PSF modules to the job site, submit all modules and the following items to METS:

1. Delivery form with Contract number and contact information
2. Installation manual and schematic wiring diagram
3. Product information, including manufacturer's name and month and year of manufacture
4. List of model, lot, and serial numbers

Submit documentation of the manufacturer's production QA, including test data showing the modules comply with the following requirements:

1. Luminous intensity as shown in the table titled "Luminance Values."
2. Power factor after burn-in.
3. Test current flow measurements in amperes after burn-in. The measured values must comply with the design qualification figures. Record the measured ampere values with rated voltage on the product labels.

Submit the manufacturer's warranty before installing LED countdown PSF modules.

86-4.03H(1)(d) Quality Control and Assurance

86-4.03H(1)(d)(i) General

The Engineer rejects a module if a visual inspection reveals any of the following defects:

1. Exterior physical damage
2. Assembly anomalies
3. Scratches
4. Abrasions
5. Cracks
6. Chips
7. Discoloration
8. Other surface defects

The Department tests LED countdown PSF modules under ANSI/ASQ Z1.4 and California Test 606. The module submitted for testing must be representative of typical production units.

Comply with testing requirements for electrical material and equipment under section 86-2.14.

86-4.03H(1)(d)(ii) Warranty

Provide a 5-year manufacturer's replacement warranty against defects or failures. The warranty period starts on the date of Contract acceptance. Furnish replacement parts within 15 days after notification of a failed module. The Department does not pay for replacement modules. Deliver replacement modules to the Department's Maintenance Electrical Shop at:

86-4.03H(2) Materials

A LED countdown PSF module must:

1. Use LED as the light source.
2. Be made of material complying with ASTM D 3935.

3. Be designed to mount behind or to replace face plates of a standard Type A housing as specified in the ITE publication *Equipment and Material Standards*, chapter 3, "Pedestrian Traffic Control Signal Indications," and the *California MUTCD*.
4. Have a minimum power consumption of 10 W for the "Upraised Hand."
5. Have internal components supported such that they withstand mechanical shock and vibration from high winds and other sources.
6. Use the required color and be the ultra-bright type rated for 100,000 hours of continuous operation for a temperature range from -40 to +74 degrees C.
7. Have replaceable signal lamp optical units.
8. Fit into the housing of a pedestrian signal section without modification.
9. Be a single, self-contained device that does not require on-site assembly for installation.
10. Have the following information permanently marked on the back of the module:
 - 10.1. Manufacturer's name
 - 10.2. Trademark
 - 10.3. Model number
 - 10.4. Serial number
 - 10.5. Lot number
 - 10.6. Month and year of manufacture
 - 10.7. Required operating characteristics, including:
 - 10.7.1. Rated voltage
 - 10.7.2. Power consumption
 - 10.7.3. Volt-ampere
 - 10.7.4. Power factor
11. Have prominent and permanent vertical markings for accurate indexing and orientation within the signal housing if a specific mounting orientation is required. Markings must be a minimum of 1 inch in height and include an up arrow and the word "up" or "top."

The circuit board and the power supply must be contained inside of the LED countdown PSF module. The circuit board must comply with TEES, chapter 1, section 6.

The enclosure containing the power supply or the electronic components of the module, except the lens, must be made of UL 94 V-0 flame-retardant material.

Each symbol must be at least 9 inches high and 5-1/4 inches wide. The lens' signal output for the "Walking Person" and "Upraised Hand" symbols and the countdown display must not exceed a ratio of 5 to 1 for the highest and lowest luminance values. The symbols must comply with ITE publication *Equipment and Material Standards*, chapter 3, "Pedestrian Traffic Control Signal Indications," and the *California MUTCD*. The 2-digit countdown timer, "Upraised Hand," and "Walking Person" indications must be electronically isolated from each other. The 3 indications must not share a power supply or interconnect circuitry.

The module must maintain an average luminance value for at least 5 years of continuous signal operation for a temperature range from -40 to +74 degrees C.

The module must operate over the specified ambient temperature and voltage range and be readable both day and night at distances up to the full width of the area to be crossed. Upon initial testing at 25 degrees C, the module must have at least the luminance values shown in the following table:

Luminance Values

PSF module symbol	Luminance
"Upraised Hand" and 2-digit countdown timer	1,094 fL
"Walking Person"	1,547 fL

The color output of the module must comply with chromaticity requirements in section 5.3 of ITE publication *Equipment and Material Standards* chapter 3, "Pedestrian Traffic Control Signal Indications."

When operating over a temperature range from -40 to +74 degrees C, the measured chromaticity coordinates of the module must comply with the following requirements for 5 years after Contract acceptance:

Chromaticity Standards (CIE Chart)

"Upraised Hand" and 2-digit countdown timer (portland orange)	$0.600 \leq X \leq 0.659$ Y: Not greater than 0.390 or less than 0.331 or less than 0.990 - X
"Walking Person" (lunar white)	X: Not less than 0.280 or greater than 0.400 Y: Not less than $0.0483 + 0.7917 * X$ or greater than $0.0983 + 0.7917 * X$

The module must not exceed the power consumption requirements shown in the following table:

Maximum Power Consumption Requirements

PSF module display	At 24 °C	At 74 °C
"Upraised Hand"	10.0 W	12.0 W
"Walking Person"	9.0 W	12.0 W
2-digit countdown timer	6.0 W	8.0 W

The wiring and terminal block must comply with section 13.02 of ITE publication *Equipment and Material Standards*, chapter 2, "Vehicle Traffic Control Signal Heads." The PSF module must have spade lugs and 3 secured, jacketed copper wires that comply with NEC and are:

1. Color coded
2. 3 feet long
3. 600 V(ac)
4. 20 AWG minimum stranded
5. Rated for service at +105 degrees C

The module must operate:

1. At a frequency of 60 ± 3 Hz over a voltage range from 95 to 135 V(ac) without flicker perceptible to the unaided eye. Fluctuations of the line voltage must have no visible effect on the luminous intensity of the indications. The rated voltage for measurements must be 120 V(ac).
2. With currently-used Department controller assemblies, including solid-state load switches, flashers, and conflict monitors. Comply with TEES, chapters 3 and 6. If an alternating current of 20 mA or less is applied to the unit, the voltage read across the 2 leads must not exceed 15 V(ac).
3. With a smart control and regulation mode that exhibits countdown displays automatically adjusted to the traffic controller's programmed intervals.

The countdown PSF module must operate during the pedestrian change interval. The module must begin counting down when the flashing "Upraised Hand" interval turns on, counting down to 0 and turning off when the steady "Upraised Hand" interval turns on.

The module's on-board circuitry must:

1. Include voltage surge protection to withstand high-repetition noise transients. The voltage surge protection must comply with NEMA Standard TS, section 2.1.6.
2. Comply with Class A emission limits for electronic noise under 47 CFR 15, subpart B.

The module must provide a power factor of 0.90 or greater.

The total harmonic distortion from a current and voltage induced in an alternating-current power line by a PSF module must not exceed 20 percent at an operating temperature of 25 degrees C.

The module's circuitry must prevent light emission perceptible to the unaided eye when a voltage of 50 V(ac) or less is applied to the unit.

When power is applied to the module, light emission must occur within 90 ms.

86-4.03H(3) Construction

Use LED countdown PSF modules from the same manufacturer.

Install the module in a standard Type A pedestrian signal housing. Special tools must not be required for installing the modules.

The installation of the module into the pedestrian signal face must require only the removal of the lens, reflector, and existing LED module.

86-4.03H(4) Payment

Not Used

Add to section 86-4.03I(1)(b):

Submit warranty documentation as an informational submittal before installing LED PSF modules.

Replace section 86-4.03I(1)(c)(ii) with:

86-4.03I(1)(c)(ii) Warranty

Submit a 5-year manufacturer's warranty against defects in materials and workmanship for LED PSF modules. The 5-year warranty period starts on the date of Contract acceptance. Furnish replacement modules within 15 days after receiving the failed modules. The Department does not pay for replacement modules. Deliver replacement modules to the Department's Maintenance Electrical Shop at:

Caltrans Escondido Maintenance Station,
1780 W. Mission Avenue, Escondido, CA,
Telephone (760) 746-2947,

Add to section 86-5.01A(1):

Loop wire must be Type 2.

Loop detector lead-in cable must be Type B.

Slots must be filled with elastomeric sealant or hot-melt rubberized asphalt sealant.

For Type E detector loops, sides of the slot must be vertical and the minimum radius of the slot entering and leaving the circular part of the loop must be 1-1/2 inches. Slot width must be a maximum of 5/8 inch. Loop wire for circular loops must be Type 2. Slots of circular loops must be filled with elastomeric sealant or hot-melt rubberized asphalt sealant.

The depth of the loop sealant above the top of the uppermost loop wire in the sawed slots must be 2 inches, minimum.

Add to section 86-5.01:

86-5.01E VIDEO IMAGE VEHICLE DETECTION SYSTEM

86-5.01E(1) General

86-5.01E(1)(a) Summary

This work applies when video image vehicle detection system (VIVDS) is shown for traffic signals.

86-5.01E(1)(b) Definitions

Video Detection Unit (VDU): Processor unit that converts the video image from the camera and provides vehicle detection in defined zones. Unit includes an image processor, extension module, and communication card.

Video Image Sensor Assembly (VIS): An enclosed and environmentally-protected camera assembly used to collect the video image.

Video Image Vehicle Detection System (VIVDS): A system that detects video images of vehicles in defined zones and provides video output.

86-5.01E(1)(c) Submittals

Submit documentation within 30 days after Contract approval but before installing VIVDS equipment.

The documentation submittal must include:

1. Certificate of Compliance: As specified in Section 6-3.05E, "Certificates of Compliance," of the Standard Specifications.
2. Site Analysis Report: Written analysis for each detection site, recommending the optimum video sensor placement approved by the manufacturer.
3. Lane Configuration: Shop drawing showing:
 - 3.1. Detection zone setback
 - 3.2. Detection zone size
 - 3.3. Camera elevation
 - 3.4. Selected lens viewing angle
 - 3.5. Illustration of detection zone mapping to reporting contact output
 - 3.6. Illustration of output connector pin or wire terminal for lane assignment.
4. Configuration Record: Windows XP PC compatible CD containing:
 - 4.1. Proposed zone designs
 - 4.2. Calibration settings
5. Mounting and Wiring Information: Manufacturer approved wiring and service connection diagrams.
6. Communication Protocol: Industry standard available in public domain. Document defining:
 - 6.1. Message structure organization
 - 6.2. Data packet length
 - 6.3. Message usability
 - 6.4. Necessary information to operate a system from a remote windows based personal computer.
7. Programming Software: CD containing set up and calibration software that observes and detects the vehicular traffic, including bicycles, motorcycles, and sub-compact cars, with overlay of detection zones and allows adjustment of the detection sensitivity for a traffic signal application.
8. Detector Performance DVD Recordings and Analysis: Performance analysis based on 24-hour DVD recording of contiguous activity for each approach. Include:
 - 8.1. Two contiguous hours of sunny condition, with visible shadows projected a minimum of 6 feet into the adjacent lanes
 - 8.2. Two 1-hour night periods with vehicle headlights present.
9. Preventative Maintenance Parts Documentation: List of equipment replacement parts for preventative maintenance, including:
 - 9.1. Electrical parts
 - 9.2. Mechanical parts
 - 9.3. Assemblies.

Allow 7 days for the Engineer to review the documentation submittal.

If the Engineer requires revisions, submit a revised submittal within 5 days of receipt of the Engineer's comments and allow 5 days for the Engineer to review. If agreed to by the Engineer, revisions may be included as attachments in the resubmittal. The Engineer may conditionally approve, in writing, resubmittals that include revisions submitted as attachments, in order to allow construction activities to proceed.

Upon the Engineer's approval of the resubmittal, submit copies of the final documents (with approved revisions incorporated) to the Engineer.

Submit an acceptance testing schedule for approval 15 days before starting acceptance testing.

When beginning acceptance testing of VIVDS and detector performance and analysis, submit approved copies of the following:

1. Configuration Record: Windows XP PC compatible CD containing:
 - 1.1. Final zone designs
 - 1.2. Calibration settings to allow reinstallation.
2. Mounting and Wiring Information: Final wiring and service connection diagrams.
 - 2.1. One copy for the Engineer
 - 2.2. A second copy wrapped in clear self-adhesive plastic, be placed in a heavy duty plastic envelope, and secured to the inside of the cabinet door.

86-5.01E(1)(d) Quality Control and Assurance

86-5.01E(1)(d)(1) General

VIVDS and support equipment required for acceptance testing must be new and as specified in the manufacturer's recommendations. Date of manufacture, as shown by date codes or serial numbers of electronic circuit assemblies, must not be older than 12 months from the scheduled installation start date. Material substitutions must not deviate from the material list approved by the Engineer.

86-5.01E(1)(d)(1)(a) Training

You must provide a minimum of 16 hours of training by a factory authorized representative for a maximum of 5 Department employees. Submit training material to the Engineer for approval at least 30 days before the proposed training. Training material content must include instructions for aligning, programming, adjusting, calibrating, and maintaining VIVDS. You must provide all materials and equipment for the training. Notify the Engineer 20 days in advance of the proposed training to obtain approval of place and time of the training. If agreement cannot be reached, the Engineer will determine the time and place.

86-5.01E(1)(d)(1)(b) Warranty

Furnish a 3-year replacement warranty from the manufacturer of VIS and VDU against defects in materials and workmanship or failures. The effective date of the warranty is the date of acceptance of the installation. Submit all warranty documentation before installation.

Replacement VIS and VDU must be furnished within 10 days of receipt of a failed unit. The Department does not pay for replacement.

Deliver replacement VIS and VDU to Caltrans Electrical Shop at:

Caltrans District 11 Signal Laboratory,
7181 Opportunity Road,
San Diego, CA, 92111

86-5.01E(2) Materials

86-5.01E(2)(a) General

VIVDS must include necessary firmware, hardware, and software for designing the detection patterns or zones at the intersection or approach. Detection zones must be created with a graphic user interface designed to allow to anyone trained in VIVDS system setup to configure and calibrate a lane in less than 15 minutes.

System elements must comply with the manufacturer's recommendations and be designed to operate continuously in an outdoor environment.

All equipment, cables, and hardware must be part of an engineered system that is designed by the manufacturer to fully interoperate with all other system components. Mounting assemblies must be corrosion resistant. Connectors installed outside the cabinets and enclosures must be corrosion resistant, weather proof, and watertight. Exposed cables must be sunlight and weather resistant.

86-5.01E(2)(a)(1) Physical and Mechanical Requirements

VIVDS must include:

1. VIS and mounting hardware. Use a clamping device as mounting hardware on a pole or mast-arm.
2. VDU
3. Power supply
4. Surge suppression
5. Cables
6. Connectors
7. Wiring for connecting to the Department-furnished Model 332L traffic controller cabinet.
8. Communication card

86-5.01E(2)(a)(2) Electrical

VIVDS must operate between 90 to 135 V(ac) service as specified in NEMA TS-1. VIS, excluding the heater circuit, must draw less than 10 W of power. Power supply or transformer for the VIVDS must meet the following minimum requirements:

Minimum Requirements for Power Supply and Transformers

Item	Power Supply	Transformer
Power Cord	Standard 120 V(ac), 3 prong cord, 3 feet minimum length (may be added by Contractor)	Standard 120 V(ac), 3 prong cord, 3 feet minimum length (may be added by Contractor)
Type	Switching mode type	Class 2
Rated Power	Two times (2x) full system load	Two times (2x) full system load
Operating Temperature	From -37 to 74 °C	From -37 to 74 °C
Operating Humidity Range	From 5 to 95 percent	From 5 to 95 percent
Input Voltage	From 90 to 135 V(ac)	From 90 to 135 V(ac)
Input Frequency	60 ± 3 Hz	60 ± 3 Hz
Inrush Current	Cold start, 25 A Max. at 115 V(ac)	N/A
Output Voltage	As required by VIVDS	As required by VIVDS
Overload Protection	From 105 to 150 percent in output pulsing mode	Power limited at >150 percent
Over Voltage Protection	From 115 to 135 percent of rated output voltage	N/A
Setup, Rise, Hold Up	800ms, 50ms, 15ms at 115 V(ac)	N/A
Withstand Voltage	I/P-0/P:3kV, I/P-FG:1.5kV, for 60 s.	I/P-0/P:3kV, I/P-FG:1.5kV, for 60 s
Working Temperature	Not to exceed 70°C at 30 percent load	Not to exceed 70 °C at 30 percent load
Safety Standards	UL 1012, UL 60950	UL 1585

Field terminated circuits must include transient protection as specified in IEEE Standard 587-1980, Category C. Video connections must be isolated from ground.

86-5.01E(2)(a)(3) Technical Requirements

Camera and zoom lens assembly must be housed in an environmentally sealed enclosure that complies with NEMA 4 standards. Enclosure must be watertight and protected from dust. Enclosure must include a thermostat controlled heater to prevent condensation and to ensure proper lens operation at low temperatures. Adjustable sun shield that diverts water from the camera's field of view must be included. Connectors, cables and wiring must be enclosed and protected from weather. An environmentally sealed (protected from dust and moisture ingress) connector must be used at the rear plate of the housing. Wiring to the connector must be sealed with silicone or putty compound.

Each camera and its mounting hardware must be less than 10 pounds and less than 1 square foot equivalent pressure area. Only one camera must be mounted on a traffic signal or luminaire arm. Top of camera must not be more than 12 inches above top of luminaire arm or 30 inches above top of traffic signal arm.

VIS must use a charge-coupled device (CCD) element, support National Television Standards Committee (NTSC) and RS170 video output formats, and have a horizontal resolution of at least 360 lines. VIS must include an auto gain control (AGC) circuit, have a minimum sensitivity to scene luminance from 0.01 to 930 foot-candle, and produce a usable video image of vehicular traffic under all roadway lighting conditions regardless of the time of day. VIS must have a motorized lens with variable focus and zoom control with an aperture of f/1.4 or better. Focal length must allow ± 50 percent adjustment of the viewed detection scene.

A flat panel video display with a minimum 8-inch screen and that supports NTSC video output must be enclosed in the Model 332L cabinet for viewing video detector images and for performing diagnostic testing. Display must be viewable in direct sunlight. Each VIVDS must have video system connections that support the NTSC video output format, can be seen in each camera's field of view, and has a program to allow the user to switch to any video signal at an intersection. A metal shelf or pull-out document tray with metal top capable of supporting the VDU and monitor must be furnished and placed on an EIA 19 inch rack with 10-32 "Universal Spacing" threaded holes in the Model 332L cabinet. System must allow independent viewing of a scene while video recording other scenes without interfering with the operation of the system's output.

Mounting hardware must be powder-coated aluminum, stainless steel, or treated to withstand 250 hours of salt fog exposure as specified in ASTM B 117 without any visible corrosion damage.

VDU must operate between -37 to $+74$ °C and from 0 to 95 percent relative humidity.

VDU front panel must have indicators for power, communication, presence of video input for each VIS, and a real time detector output operation. Hardware or software test switch must be included to allow the user to place either a constant or momentary call for each approach. Indicators must be visible in daylight from 5 feet away.

VDU must have a serial communication port, EIA 232/USB 2.0 that supports sensor unit setup, diagnostics, and operation from a local PC compatible laptop with Windows XP or later version operating system. VIVDS must have an Ethernet communication environment, including Ethernet communication card. VIVDS must include central and field software to support remote real-time viewing and diagnostics for operational capabilities through wide area network (WAN).

VDU, image processors, extension modules, and video output assemblies must be inserted into the controller input file slots using the edge connector to obtain limited 24 V(dc) power and to provide contact closure outputs. Cabling the output file to a "D" connector on the front of the VDU is acceptable. No rewiring to the standard Model 332L cabinet is allowed. Controller cabinet resident modules must comply with the requirements in Chapter 1 and Sections 5.2.8, 5.2.8.1, 5.2.8.2, 5.4.1, 5.4.5, 5.5.1, 5.5.5, and 5.5.6 of TEES.

86-5.01E(2)(a)(4) Functional Requirements

VIVDS must support normal operation of existing detection zones while a zone is being added or modified. Zone must flash or change color on a viewing monitor when vehicular traffic is detected. Length and width of each detection zone for each lane must be approved by the Engineer.

Software and firmware must detect vehicular traffic presence, provide vehicle counts, set up detection zones, test VIVDS performance, and allow video scene and system operation viewing from the local traffic management center/office. VIVDS must support a minimum of 2 separate detection patterns or zones that can be enacted by a remote operator at the signal controller cabinet.

VIVDS detection zone must detect vehicles by providing an output for presence and pulse. At least one detection output must be provided for each detection zone. One spare detection output must be provided for each approach. Detection performance must be achieved for each detection zone with a maximum of 8 user-defined zones for every camera's field of view.

VIVDS must detect the presence of vehicles under all types of adverse weather and environmental conditions, including snow, hail, fog, dirt, dust or contaminant buildup on the lens or faceplate, minor camera motion due to winds, and vibration. Under low visibility conditions, the VIVDS must respond by selecting a fail-safe default pattern, placing a constant call mode for all approaches. VIVDS outputs must assume a fail-safe "on" or "call" pattern for presence detection if video signal or power is not available and must recover from a power failure by restoring normal operations within 3 minutes without manual intervention. If powered off for more than 90 days, system must maintain the configuration and calibration information in memory.

Detection algorithm must be designed to accommodate naturally occurring lighting and environment changes, specifically the slow moving shadows cast by buildings, trees, and other objects. These changes must not result in a false detection or mask a true detection. VIVDS must not require manual interventions for day-night transition or for reflections from poles, vehicles or pavement during rain and weather changes. VIVDS must suppress blooming effects from vehicle headlights and bright objects at night.

Vehicle detection must call service to a phase only if a demand exists and extend green service to the phase until the demand is taken care of or until the flow rates have reduced to levels for phase termination. VIVDS must detect the presence of vehicular traffic at the detection zone positions and provide the call contact outputs to the Model 170E or Model 2070 controller assembly with the following performance:

Detector Performance

Requirements	Performance during AMBER and RED interval	Performance during GREEN interval
Average response time after vehicle enters 3 feet into detection zone or after exiting 3 feet past detection zone	≤ 1 s	≤ 100 ms
Maximum number of MISSED CALLS in 24-hour duration, where MISSED CALLS are greater than 5 s during AMBER and RED intervals and greater than 1 s during GREEN intervals (upon entering 3 feet of detection zone or after exiting 3 feet past detection zone).	0	10
Maximum number of FALSE CALLS in 24-hour duration (calls greater than 500ms without a vehicle present)	20	20

VIVDS must be able to locally store, for each lane, vehicle count data in 5, 15, 30, and 60 minute intervals for a minimum period of 7 days and be remotely retrievable. VIVDS must count vehicular traffic in detection zone with a 95 percent accuracy or better for every hour counted over a morning or an evening peak hour. VIVDS detection zone tested must have a minimum range of 50 feet behind the limit line for each approach. Testing period will be pre-approved by the Engineer 48 hours in advance.

86-5.01E(3) Construction

Install VDU in a Department-furnished Model 170E or Model 2070 controller assembly. Install VIS power supply or transformer on a standard DIN rail using standard mounting hardware and power conductors wired to DIN rail mounted terminal blocks in the controller cabinet.

Wiring must be routed through end caps or existing holes. New holes for mounting or wiring must be shop-drilled.

Wire each VIS to the controller cabinet with a wiring harness that includes all power, control wiring, and coaxial video cable. Attach harness with standard MIL type and rated plugs. Cable type and wire characteristics must comply with manufacturer's recommendations for the VIS to cabinet distance. Wiring and cables must be continuous, without splices, between the VIS and controller cabinet. Coil a minimum of 7 feet of slack in the bottom of the controller cabinet. For setup and diagnostic access, terminate serial data communication output conductors at TB-0 and continue for a minimum of 10 feet to a DB9F connector. Tape ends of unused and spare conductors to prevent accidental contact to other circuits.

Label conductors inside the cabinet for the functions depicted in the approved detailed diagrams. Label cables with permanent cable labels at each end.

Adjust the lens to view 110 percent of the largest detection area dimension. Zones or elements must be logically combined into reporting contact outputs that are equivalent to the detection loops and with the detection accuracy required.

Verify the performance of each unit, individually, and submit the recorded average and necessary material at the conclusion of the performance test. Determine and document the accuracy of each unit, individually, so that each unit may be approved or rejected separately. Failure to submit necessary material at the conclusion of testing invalidates the test. The recorded media serves as acceptance evidence and must not be used for calibration. Calibration must have been completed before testing and verification.

Verify the detection accuracy by observing the VIVDS performance and recorded video images for a contiguous 24-hour period. The recorded video images must show the viewed detection scene, the detector call operation, the signal phase status for each approach, the vehicular traffic count, and time-stamp to 1/100 of a second, all overlaid on the recorded video. Transfer the 24-hour analysis to DVD.

VIVDS must meet the detection acceptance criterion specified in the table titled "Detector Performance."

Calculate the VIVDS's vehicular traffic count accuracy as $100[1 - (|TC - DC|/TC)]$, where DC is the detector's vehicular traffic count and TC is the observed media-recorded vehicular traffic count and where the resulting fraction is expressed as an absolute value.

The Engineer will review the data findings and accept or reject the results within 7 days. Vehicle anomalies or unusual occurrences will be decided by the Engineer. Data or counts not agreed by the Engineer will be considered errors and count against the unit's calibration. If the Engineer determines that the VIVDS does not meet the performance requirements, you must re-calibrate and retest the unit, and resubmit new test data within 7 days. After 3 failed attempts, you must replace the VIVDS with a new unit.

Notify the Engineer 20 days before the unit is ready for acceptance testing. Acceptance testing must be scheduled to be completed before the end of a normal work shift. You must demonstrate that all VIS and VDU satisfy the functional requirements.

Add to section 86-5.01:

86-5.01F Closed Circuit Television (CCTV) System

86-5.01F(1) General

Closed circuit television (CCTV) system consists of conduit, pull boxes, conductors, cable, telephone demarcation cabinet, Category 5E cable, CCTV camera assembly, software, CCTV pole, CCTV cabinet, fiber distribution unit, media converter, media converter center, video encoder and serial to Ethernet conversion unit, as shown and as specified in the special provisions.

86-5.01F(1)(a) Submittals

A minimum of 10 working days before the scheduled delivery of the closed circuit television camera assembly to the project site, submit:

1. A certificate of compliance certifying that the closed circuit television camera assembly complies with the requirements of the special provisions. The certificate must include a copy of all applicable test reports on the closed circuit television camera assembly.
2. Four sets of documentation containing complete specifications and operation details of each of the components of the CCTV camera assembly.
3. Four copies of the maintenance manuals for the pan and tilt unit.
4. Four sets of wiring diagrams showing wire colors, functions, and pin assignments for connecting these CCTV camera assembly components to each other and to the encoder.
5. Manufacturer's cut sheets or specifications data of CCTV camera cable assemblies, including connectors with strain relief backshells.
6. A copy of the CCTV camera cable assembly testing procedures and manufacturer's test results.

86-5.01F(2) Materials

86-5.01F(2)(a) Closed Circuit Television Camera Assembly

Prototype equipment will not be allowed. All equipment must be current standard production units.

The CCTV camera assembly must include these components:

1. Camera
2. Motorized zoom lens
3. Environmental enclosure with sun shield or shroud
4. Wiper
5. Pan and tilt unit

The CCTV camera assembly, including the pan and tilt unit must not exceed 1 square foot EPA, and not be greater than 8 inches wide x 18 inches high x 15 inches deep. Any external cables must not interfere with or limit the continuous pan and tilt operation.

The CCTV camera assembly must have all necessary wiring, cables, and connectors. All CCTV camera assemblies must be plug-compatible, interchangeable and suitable for use with the CCTV camera cable assembly described in the special provisions.

You must apply an approved weather-resistant spray to the inside of the connectors before engaging the connectors.

Closed circuit television camera assembly components must be rated for NEMA 4X, IP 66 or IP 67.

86-5.01F(2)(a)(i) Camera

86-5.01F(2)(a)(i)(1) Technical Requirements

All cameras supplied must meet the following:

Parameter	Specification
Optical Device	CCD, Color, interline transfer
Optical CCD Format Size	1/4 - inch format
Horizontal Resolution	460 television lines (minimum)
Sensitivity	1 lux at 1/60 s shutter speed (measured with f1.6 lens)
Scanning System	525 lines 2:1 interlace

The camera must be equipped with an electronic shutter with adjustable speeds ranging from 1/60 second to 1/30,000 second.

86-5.01F(2)(a)(i)(2) Electrical Requirements

All cameras supplied must meet the following:

Parameter	Specification
Operating Voltage	120 V(ac) \pm 10 percent (external adapter allowed)
Power Consumption	50 W (Maximum)
Video Output Signal	Standard NTSC color TV
Video Output Connector	Standard BNC bulkhead on rear of camera
Signal To Noise Ratio	>48 dB
Synchronization	Internal sync or phase adjustable line lock
Video Output Level	1.0 V p-p (75 Ω composite)
Gain Control	Automatic
Automatic Back Focus (Automatic White Balance)	Required

Programming must be stored non-volatile memory and the CCTV assembly firmware must be updateable via serial communication.

86-5.01F(2)(a)(i)(3) Environmental Requirements

All cameras supplied must meet the following:

Parameter	Specification
Operating Temperature	From 15 to 120°F
Storage Temperature	From -40 to 140°F
Operating Humidity	From 20 to 80 percent non-condensing
Storage Humidity	From 20 to 90 percent non-condensing

86-5.01F(2)(a)(ii) Motorized Zoom Lens**86-5.01F(2)(a)(ii)(1) General**

The lens must have motors for zoom, focus and iris.

The lens must have capability for focus and zoom preset positions. A telescopic converter or extender must not be used to achieve required focal length range.

86-5.01F(2)(a)(ii)(2) Technical and Functional Requirements

The lens must meet the following:

Parameter	Specification
Format	1/4-inch format
Iris	Motorized , with automatic and manual adjust modes
Operating temperature	From 15 to 120°F
Focal Length	Maximum not less than 3.15 inch (Optical power not less than 21X)
Lens Aperture	From F1.6 to F3.6
Horizontal angle of view at Maximum Focal Length	Not less than 2.2 degrees for 1/4-inch format camera

When the camera is pointed at a very bright object and or when the camera and lens is first turned on, the image produced by the lens and camera combination must not optically "oscillate" (i.e., produce an image that alternates from too light to too dark) or otherwise be unstable.

Each lens must have an automatic, motor-driven iris with manual override.

The lens must include mechanical or electrical means to protect the motors from over running in the extreme position.

The iris must be controlled directly through the camera in automatic mode and from any keyboard connected into the camera system in the manual mode. The automatic iris must provide continuous aperture adjustments of the lens as determined by the amount of light reaching the camera imager. The power supply and electronics for iris motor must be contained within the environmental housing.

When the power is removed from the lens, the lens iris must automatically close.

The motorized-iris cable must be strain relieved or sufficiently rugged such that the cable will not fail at the point where it leaves the lens assembly.

86-5.01F(2)(a)(iii) Environmental Enclosure

86-5.01F(2)(a)(iii)(1) General

The environmental enclosure must be the sealed, pressurized type, designed to withstand exposure to sand, dust, fungus, and salt atmosphere, and house the assembled camera, motorized zoom lens and all internal wiring.

It must operate on a voltage range of 120 V(ac) ±10 percent power source.

The enclosure must include an internal thermostatically controlled heater assembly to minimize external faceplate condensation.

The housing must have a wiper for wiping clean the external face of the housing window in front of the camera lens.

The enclosure must include a sun shield or shroud to provide protection from direct solar radiation.

You have the option of providing a sealed, pressurized Integrated Optics Cartridge (IOC) housed in a NEMA 4X rated enclosure.

The enclosure or IOC must be pressurized with 5 psi dry nitrogen. The enclosure must have a valve for pressurizing. In addition, a pressure relief valve with a 20 psi rating must be provided to protect the enclosure from overcharging. The notation "CAUTION - PRESSURIZED" must be printed on the enclosure. The letter height must be at least 1/4 inch.

86-5.01F(2)(a)(iv) Wiper

86-5.01F(2)(a)(iv)(1) General

The wiper must have a wiper assembly, which includes blade and arm, and any mechanical, electrical or communication interfaces required to perform the function specified. The wiper must be designed to operate under damp or wet conditions, such as fog or rain, which leave external moisture on the housing window. The wiper assembly must be designed for general maintenance that can be performed in the field.

86-5.01F(2)(a)(iv)(2) Technical and Functional Requirements

The housing must meet the following:

Parameter	Specification
Construction	All aluminum
Finish	White, light beige or gray that is either baked enamel or polyester powder coat
Weight	Less than 47 lb excluding heater
Camera Mounting	Platform mount with adjustment fore and aft

The camera lens must be positioned in the center of the housing window.
 The housing unit must have lens preset capabilities.
 The housing must not interfere with the widest viewing angle of the motorized zoom lens.
 The camera enclosure must not incur any physical damage after a shock, return to normal operation immediately and operate within the specified vibration (see Note 1 below table).

Parameter	Specification
Shock	Up to 5 G while in non-operation mode
Vibration	From 5 Hz to 60 Hz with 0.083 inch total excursion, and 5 G rms vibration from 60 Hz to 1000 Hz.

Note 1: Where the manufacturer's cut sheet or specification data does not contain shock and vibration data a listing of at least 2 project sites with identical equipment, with similar installation conditions and similar traffic patterns showing continuous functional performance of at least 2 years may be substituted.

Any enclosure supplied must include a sun shield or shroud to protect the housing from the direct rays of the sun. The sun shroud must be made specifically for the model of enclosure that is selected.

86-5.01F(2)(a)(v) Pan And Tilt Unit

86-5.01F(2)(a)(v)(1) General

The pan and tilt unit must consist of the pan and tilt unit itself along with any electrical or communication interfaces required to perform the functions specified.

The pan and tilt unit must be designed to operate under a full range of environmental conditions. The pan and tilt unit with camera assembly mounted must withstand a wind load of 80 mph. The cable connector must be fully weather protected. External body components must be manufactured from aluminum that have been anodized, painted or coated to prevent oxidation and corrosion.

Access into the pan and tilt unit for routine maintenance or adjustments must not require removal of the pan and tilt from the installation site, nor removal of the camera enclosure from the pan and tilt unit. Access cover must be readily removable regardless of the tilt position.

86-5.01F(2)(a)(v)(2) Technical Requirements

The housing must meet the following:

Parameter	Specification
Pan and Tilt Worms	Ground and polished Stainless Steel
Pan and Tilt Worm Gears	Non-metallic material
Mounting (Base)	7 inch ± 0.013 inch diameter bolt circle Check Plans
Camera Mount	Compatible with camera housing
Bearings on Rotating Surfaces	Heavy duty roller type
Overload Protection	Provided - internal
Operating Temperature	From -10 to 140°F
Construction	Corrosion resistant steel or aluminum
Finish	Weather resistant paint or polyurethane
Seals	"O" ring or gaskets for all weather protection of pan and tilt unit and cables.

86-5.01F(2)(a)(v)(3) Functional Requirements

The housing must meet the following:

Parameter	Specification
Braking: Pan And Tilt	Mechanical or Electrical to limit coast
Overload Protection	Motors: Impedance protected
Angular Travel	Pan: From 0 to 355 degrees horizontal, Continuous Tilt: From +30 degrees up to -80 degrees down
Pan Speed	From 0.1 to 40 degrees/s variable-speed
Tilt Speed	From 0.1 to 20 degrees/s variable-speed
Pan And Tilt Position Preset	Positions camera to a predetermined azimuth, elevation and lens position (Minimum of 64 Presets)

86-5.01F(2)(a)(v)(4) Pan and Tilt Stops

The pan and tilt unit must have pan and tilt stops. The settings of these pan and tilt stops will be determined by the Engineer.

86-5.01F(2)(b) Software and Operational Requirements

The proposed camera protocol must be compatible with the existing system that uses Baxall's control which uses Pelco D protocol. The camera control protocol used by the camera assembly must be either an open public domain protocol, Pelco D, or other protocol convertible to Pelco D via translator. All functions described must be available using the described protocol. If a protocol other than Pelco D is proposed, you must provide a version of Baxall's camera control software "PC Control" or latest equivalent version that includes the new protocol as a choice for the new camera locations. The version of camera control software must not interfere with the operation of any other camera locations that use Pelco D. All camera control functions must be through the RS-422 communications interface.

Operator functions must be:

1. Pan Right
2. Pan Left
3. Tilt Up
4. Tilt Down
5. Zoom In
6. Zoom Out
7. Focus Near
8. Focus Far
9. Iris Open
10. Iris Close
11. Iris Manual
12. Iris Auto
13. Pan Stop
14. Tilt Stop
15. Zoom Stop
16. Focus Stop
17. Iris Stop

Administrative functions must be:

1. Status Query
2. Set Char. Display
3. Activate Char. Display
4. Blank Char. Display
5. Set Preset Position
6. Go to Preset Position
7. Set Relay

8. Reset Relay
9. Turn on Camera
10. Turn off Camera
11. Wiper on
12. Wiper off
13. Heater Control

86-5.01F(2)(b)(i) Camera Control and Configuration

The existing system keyboard is a BAXALL Keyboard Part Number ZKX3-J. A copy of the keyboard manual is available for review upon request.

Pan and tilt position presets must be programmable via the system keyboard.

The system keyboard must control these operator basic functions:

1. Pan Left, Pan Right and Pan Stop controlled by Joystick.
2. Tilt Up, Tilt Down and Tilt Stop controlled by Joystick.
3. Zoom In, Zoom Out and Zoom Stop controlled by Zoom In and Zoom Out button.
4. Focus Near, Focus Far and Focus Stop controlled by Near Focus and Far Focus button.
5. Iris Open, Iris Close and Iris Stop controlled by Open Iris and Close Iris button.
6. Camera selections made by numeric keypad on system keyboard.
7. Monitor selections made by numeric keypad on system keyboard.

The stop actions for all Pan, Tilt, Zoom, Focus and Iris features will be issued once the Joystick, Zoom, Focus and Iris buttons are released.

The camera administrative functions must be accessible via system keyboard or by software installed on a personal computer. If the software method is used, the camera manufacturers menu system may be used.

86-5.01F(2)(c) Closed Circuit Television Camera Cable Assembly

86-5.01F(2)(c)(i) General

The closed circuit television (CCTV) camera cable assembly must conform to the details shown and the special provisions.

The interconnect wiring between the CCTV camera assembly and the camera encoder unit (CEU) must be a composite cable that includes flexible 75-ohm coaxial cable, AC power and control cable.

86-5.01F(2)(c)(i)(1) Submittals

Not Used.

86-5.01F(2)(c)(ii) Technical Requirements

The camera cable assembly connector assignments for C1, C2 and C3 connectors are shown. C1, C2 and C3 connectors must be the connectors specified or equal. C1, C2, C3 and C4 connectors are also referred to as Conn 1, Conn 2, Conn 3 and Conn 4, respectively, as shown.

For Connector 1, the connector type must be compatible, either directly or via adapter, with male AMP 206044-1 of existing field cameras.

The Connector C4 must conform to the following:

Connector C4 Assignment			
Pin	Function	Wire Color	Wire Gauge
Blade	Camera Power, AC Low	White	18 AWG
Blade	Camera Power, AC High	Black	18 AWG
Ground	Camera Power, Ground	Green	18 AWG

The CCTV camera cable assembly must conform to the following:

1. General

Overall Cable, Nom. weight/1,000 feet not to exceed:	291 lbs.
Overall Cable Minimum Bending Radius:	9 inches
All Materials, Temperature Rating, meet or exceed:	From -40 to +175 °C
Overall Cable, Outside Diameter, not to exceed:	0.73 inches
Outside Jacket, Tinned Copper Braid Shield, minimum:	80 percent
Pulling tension, maximum:	500 lbs.
Overall Cable, Outside Jacket:	Black Thermoplastic Elastomer

2. Coax Cable

Coax Tinned Copper Braid Shield, minimum:	95 percent
Coax Insulation Material:	Solid Polyethylene
Coax Core Outside Diameter:	0.121 inch
Coax Outside Diameter:	0.178 inch
Coax Outside Jacket:	Cotton Braid

3. Single Cable - Shielded group of 3 No. 18 AWG and with a group of 4 No. 22 AWG inside cables. The individual conductors must be color coded with PVC insulation.

4. Drain wire must be provided for each group of cables.

86-5.01F(2)(c)(iii) Electrical Requirements

Coaxial Cable	
Nominal Impedance:	75 Ω
Nominal Capacitance:	70.54 pF/m
Nominal Velocity of Propagation:	66 percent
Nominal Delay:	5.05 ns/m
Attenuation	
at 1 MHz	0.0197 dB/m
at 5 MHz	0.0892 dB/m
at 10 MHz	0.0971 dB/m
at 50 MHz	0.1263 dB/m
at 100 MHz	0.1673 dB/m
Dielectric Strength:	
	1900 V(rms)
Nominal Shield DC Resistance at 20 °C:	0.01378 Ω/m
Nominal Conductor DC Resistance at 20 °C:	0.32808 Ω/m
Maximum Operating Voltage:	300 V (rms)

SHIELDED GROUP OF 3 No. 18 AWG CONDUCTORS	
Nominal Conductor DC Resistance at 20 °C:	0.02133 Ω/m
Nominal Shield DC Resistance at 20 °C:	0.03642 Ω/m
Nominal Capacitance (to Adj. conductors and Shield)	292 pF/m

SHIELDED GROUP OF 4 No. 22 AWG CONDUCTORS	
Nominal Conductor DC Resistance at 20°C:	0.05151 Ω /m
Nominal Shield DC Resistance at 20°C:	0.03675 Ω /m
Nominal Capacitance (to Adj. conductors and Shield)	230 pF/ m

86-5.01F(2)(c)(iv) Construction

Control cable must be routed from the CCTV camera assembly to the camera encoder and AC power inside the camera pole. Wiring must run continuous from source to destination without splices.

Cable slack of not less than 3 feet must be provided for equipment movement at pull boxes, vaults or cabinets. The cable must be secured and coiled neatly.

The cables and connectors must be installed to allow the camera and lens to be disconnected without removing the environmental camera housing.

Cable grip and J-hook must be as shown.

You are responsible for all testing and documentation required to establish approval and acceptance of the production, installation, and operation of these materials and equipment.

You must provide all materials necessary to make the connectors functional. All materials used to make the connectors must be compatible and must adhere to manufacturer's recommendations.

86-5.01F(2)(d) Closed Circuit Television Cabinet

Conform to the requirements of section 86-3.04 for Model 334L cabinet.

86-5.01F(2)(e) Fiber Distribution Unit

You must install all related equipment to interface the fiber distribution unit (FDU) to the incoming fiber optic communication cables.

The units must accommodate the fiber optic cable described in the special provisions.

Type A FDU must accommodate termination of not less than 72 individual fibers.

Type C FDU must accommodate termination of not less than 12 individual fibers.

The FDU must provide interconnect capability and must include the following:

1. A patch panel to terminate singlemode fiber with SC type connector feed through adapters.
2. Storage for splice trays.
3. A slide out metal shelf for storage of up to 2 spare jumpers each measuring 36-inches long

The patch panel must be hinged to provide easy access and maintenance. Brackets must be provided to spool the incoming fiber a minimum of three turns, each turn of not less than 10 inches in length, before separating out individual fibers to the splice tray. Strain relief must be provided for the incoming fiber optic cable. All fibers must be terminated and identified in the FDU.

The FDU must be EIA 19-inch rack mountable.

86-5.01F(2)(f) Media Converter

Media converter must conform to the details shown and must be in conformance with the special provisions.

Media converter optical link range must be suitable for the operational distances shown.

Media converter must have the following features:

Media Converter	
Feature	Parameter/Remarks
Ports	RJ-45,EIA/TIA 568A/B, Modular (10/100Base-TX) 100 Mbps duplex fiber port with SC-Type connector (singlemode required)
10/100Base-TX port	Automatically senses 10 Mbps or 100 Mbps connection speed, Auto-negotiates Half- or Full-Duplex mode, Auto-selects MDI/MDI-X media type
Fiber port	Half /Full-Duplex mode selector
Network media	100Base-TX and 100Base-FX: Singlemode fiber optic cable 8/125 μm or 9/125 μm, full-duplex to 20 km for SM Wavelength of 1310/1550nm
Serial Console Port	EIA 232
Protocol	SNMP manageable through SNMP-enabled networking management system via console or add-on module. SSL/SSH
Data Transfer Rate	100 Mbps (Half-Duplex), 200 Mbps (Full-Duplex)
Status LED indicators	power, copper link/activity, fiber optic link/activity, half/full duplex mode
Mounting	Standalone or Slot/Chassis Configuration as required
Power Supply	Supply voltage range 100 V(ac) to 135 V(ac) at 60 Hz. Standalone units: Internal power supply (maximum power consumption 6 W) or external power supply (maximum power consumption 14 W) Chassis units: only one power supply permitted
Power Adapter	Operating Temperature: From 0 to 35 °C Operating Humidity: Up to 85 percent (non-condensing)
Standards Compliance	IEEE 802.3i; 802.3u FCC: Class A or Class B, 10/100Base-TX, 100Base-FX
Warranty	Not less than 5 years for media and chassis (excludes power supplies, fans and lasers)

86-5.01F(2)(i) Media Converter Center

Not Used

86-5.01F(2)(j) Video Encoder

Video encoder must conform to the details shown and the special provisions.

Video encoder must have the following features:

Video Encoder	
Feature	Parameter/Remarks
Video Standard	SMPTE-170, 75 ohm
Video Input	75 ohm, BNC Connector
Video Compression	MPEG-4 Part 2 (ISO/IEC 14496-2) and Motion JPEG
Video Transmission	768kHz at 30fps
Network Interface	Auto sensing 10/100 BaseT port, IEEE 802.3
Protocol Support	TCP/IP, UDP/IP (unicast and multicast), Telnet
Frame Rate	Up to 30 fps at 2CIF
Serial Data Connector	DE-9
Serial Line Standard	Selectable between EIA-232, EIA-422, EIA-485
Serial Port Function	CCTV command and control
Serial Console Port	EIA-232
Encoder Software Updates	Via Serial port or network port
Encoder Configuration	Via Serial port or network port
Encoder Identification	IP addressable
Image quality and frame rate	configurable
Physical	1U height Rack Mountable, 12" Deep
Operating Temperature	From 41 to 120 degrees F
Operating Humidity	80 percent maximum relative humidity, non-condensing
Power Input	Power supply (24 V(dc) maximum) or 110 V(ac), 30 watts (maximum) consumption

86-5.01F(2)(k) Serial To Ethernet Conversion Unit

The serial to Ethernet conversion unit (SECU) must conform to the details shown and the special provisions.

The SECU must have the following features:

Serial to Ethernet Conversion Unit	
Feature	Parameter/Remarks
Support Protocols	ARP, UDP, TCP, Telnet, ICMP
Serial Device Support	Asynchronous, 7 or 8 bit with or without parity
Network Interface	Ethernet, 10/100BaseT
Network Connector	Modular
Serial Interface	EIA 232, DCE Configuration
Serial Interface Connector	170 Controller male 44-pin edge connector. The card edge connector must be fully compatible with the 170 Controller's modem card slot.
Data Rates	From 300 bps to 115 kbps, must transmit and receive 3600 bytes of serial data without interruption
Control Lines	RTS, CTS, DSR, DCD, DTR
Software Flow Control	XON, XOFF
Hardware Flow Control	CTS/RTS
Management	SNMP, Local console port log in, Telnet log in, Menu driven user selection and web based interface.
Console Port	EIA-232 with DE-9 Female connector
Indicators	Good Link, Network transmit/receive data, EIA-232, Transmit/Receive Data
Indicator Type	LED
Addressing	IP Addressable
Dimensions (nominal)	The unit must be a plug-in card for the 170 Controller. The form factor must conform to the mechanical requirements as shown in appendix A2-7, TEES, March 12, 2009
Operating Temperature	Must conform to TEES date 5/12/2009, Chapter 1, Section 1.8.4.
Power	12 V(dc), 3 watts maximum from the 170 Controller's edge connector
Warranty	Three Years

86-5.01F(3) Construction

86-5.01F(3)(a) Installation

You must make all the necessary adjustments on different components of the CCTV camera assembly. This includes the back-focus and tracking adjustments on the lens and color balancing of the camera.

You must ensure the back-focus adjustment on the camera is such that the lens focus is properly set and maintained when adjusting the focal length from zoom to wide angle. You must make this adjustment with the lens iris at full open position. This adjustment must be made such that when the zoom is adjusted from long range (telephoto) to wide angle, no refocusing is necessary.

The Engineer will notify you of the pan and tilt presets and stops for you to set prior to the CCTV camera assembly installation check. You must perform the installation check in the presence of the Engineer. At your option, the test of the operation (pan, tilt, zoom, iris and wiper) of the pan and tilt unit may be performed at the CCTV cabinet adjacent to the camera or by remote keyboard location. You must furnish a color video monitor, for testing only, to view the actual camera image. Upon completion of the installation check, the Engineer will verify operation of the pan and tilt unit. Any additional adjustments necessary to restore the presets and stops to acceptable parameters is at your expense.

86-5.01F(3)(b) Pre-Acceptance Testing

For each CCTV system location perform the specific quality control requirements for testing and documentation described in the special provisions. Notify the Engineer in writing fifteen days prior to the scheduled testing. All testing must be performed by you, at a mutually agreed time and place, and in the presence of the Engineer. Demonstrate all the features of the CCTV system. Provide the necessary equipment required to access the CCTV equipment for testing. The Engineer will use the results from the pre-acceptance testing, and may discuss with the on-site technician, to determine settings used in final testing and documentation of the CCTV system.

86-5.01F(3)(c) Testing and Documentation

You are responsible for all testing and documentation required for approval and acceptance of the production, installation, and operation of these materials and equipment. The following identifies the specific quality control requirements for testing and documentation:

1. Test all cables, after installation with connectors attached, for continuity and shorts or grounds.
2. Adjust and set limit stops to the pan and tilt unit at each camera site to prevent the view of the areas outside of the roadway system. The final settings will be approved by the Engineer.
3. Perform a local functional test at each of the CCTV locations. At your option, the test may be performed directly at the CCTV cabinet or remotely via keyboard or keyboard and personal computer. Verify all the CCTV features. You must provide all test equipment.
4. Arrange to have a technician, qualified to work on the closed circuit television assembly and employed by the closed circuit television assembly manufacturer or the manufacturer's representative, present at the time the equipment is turned on.

86-5.01F(4) Payment

Not Used.

Add to section 86-5.01:

86-5.01G TRAFFIC MONITORING STATION

86-5.01G(1) General

86-5.01G(1)(a) Summary

Traffic monitoring station consists of cabinets, controller units, detector loops, pull boxes, conduits, conductors and cables, piezoelectric sensor units, and appurtenances.

86-5.01G(1)(b) Definitions

Piezoelectric Sensor Unit: A sensor element in a molded polyurethane elastomer with a transmission cable.

Transmission Cable: A cable, factory-attached to the piezoelectric sensor unit. The cable is similar or equal to type RG58 coaxial cable with a nominal outside diameter of 3/16-inch.

86-5.01G(1)(c) Submittals

Not Used

86-5.01G(1)(d) Quality Control and Assurance

86-5.01G(1)(d)(1) General

Piezoelectric Sensor Unit Pre-Installation Testing: Department forces will perform pre-installation testing of piezoelectric sensor units prior to field installation. Methods and results of pre-installation testing will be available to the Contractor.

86-5.01G(1)(d)(1)(a) Training

Not Used

86-5.01G(2) Materials

The following materials will be Department-furnished as provided under "Control of Materials" of these special provisions:

1. Piezoelectric sensor unit
2. Plastic standoffs
3. Epoxy sealant for piezoelectric sensor unit installation

The Contractor's responsibility is limited to that provided for in Section 6-2.03, "Department-Furnished Materials," of the Standard Specifications.

86-5.01G(3) Construction

Piezoelectric Sensor Installation:

1. Install piezoelectric sensor perpendicular to traffic.
2. Clean the piezoelectric sensor with isopropyl alcohol or other non-petroleum based solvent.
3. Cut slots cut in the pavement. Slots must be brushed on the bottom and sides with a wire brush, washed, then blown clean and dry with compressed air before installing the piezoelectric sensor. Residue resulting from slot cutting operations must not be permitted to flow across shoulders or lanes occupied by public traffic and must be removed from the pavement surface.

Plastic Standoffs - Use the plastic standoffs to suspend the piezoelectric sensor in the sawed slot. Plastic standoffs must be installed as shown.

Epoxy Sealant:

1. The mixing ratio must be in conformance with the manufacturer's recommendations. No more material must be mixed than can be used within the gel time from the time mixing operations are started. The gel time, maximum, is 30 minutes.
2. When automatic mixing equipment is used for mixing the sealant, the provisions in the second paragraph in Section 85-1.02E, "Epoxy Adhesive," of the Standard Specifications, for checking the ratio of the components, applies.

Fill slots for piezoelectric sensor with epoxy sealant as follows:

1. Atmospheric and surface temperature must be above 41 °F. Epoxy sealant must not be permitted to flow into the slot for the transmission cable. Protect the loop sealant from all traffic for at least 1 hour after installation when the pavement surface temperature is 41 °F or above.
2. After setting the sensor and plastic standoffs into the slot, add sealant along one side of the sensor until the sealant has filled the space below the sensor. Care must be taken to not create voids within the sealant material. The slot must be filled with sealant to a height slightly above finished grade as determined by the Engineer. Before setting, surplus sealant must be removed from the adjacent road surfaces without the use of solvents.

Transmission Cable:

1. Transmission cable installation must conform to the provisions in Section 86-5.01A(4), "Installation Details," of the Standard Specifications.
2. Where sawed slots cross two different types of pavement material or two different panels of PCC pavement, install a conduit across the joint, as shown in "Curb Termination Details-Type B" on Standard Plan ES-5D, to contain the transmission cable and act as an expansion/deflection fitting.
3. Transmission cable must be installed in the slot with a minimum of twisting.
4. Slots for transmission cable must be filled with elastomeric sealant. Sealant must not be permitted to flow into the slot for the piezoelectric sensor.

5. No splices of transmission cable other than the factory splice or splice by Department forces are permitted. Install transmission cable continuous from the piezoelectric sensor to the controller cabinet without any additional splices.
6. Identification for cable banding purposes must use the description shown.
7. Coil a minimum of 6 feet of slack of transmission cable neatly in the bottom of the controller cabinet. Cable ends must be taped weatherproof.

86-5.01G(4) Functional Requirements

Department forces will perform acceptance tests on piezoelectric sensor units similar to the tests performed for pre-installation testing. Acceptable performance values must be equal to or better than the values yielded in piezoelectric sensor unit pre-installation testing. Repair or replacement of piezoelectric sensor units are at your expense.

Replace "Reserved" in section 86-5.03 of the RSS with:

86-5.03A General

86-5.03A(1) Summary

Section 86-5.03 includes specifications for installing accessible pedestrian signals (APS). Comply with TEES.

86-5.03A(2) Definitions

accessible pedestrian signal: Accessible pedestrian signal as defined in the *California MUTCD*.

accessible walk indication: Activated audible and vibrotactile action during the walk interval.

ambient sound level: Background sound level in dB at a given location.

ambient sound sensing microphone: Microphone that measures the ambient sound level in dB and automatically adjusts the APS speaker's volume.

APS assembly: Assembly that includes a pushbutton to actuate the APS components.

audible speech walk message: Audible prerecorded message that communicates to pedestrians which street has the walk interval.

programming mechanism: Device to program the APS' operation.

pushbutton information message: Pushbutton information message as defined in the *California MUTCD*.

pushbutton locator tone: Pushbutton locator tone as defined in the *California MUTCD*.

vibrotactile pedestrian device: Vibrotactile pedestrian device as defined in the *California MUTCD*.

86-5.03A(3) Submittals

Before shipping the APS units to the job site, submit the units with the following to METS:

1. Delivery form including Contract number and your contact information
2. Manufacturer's name
3. Model, lot, and serial numbers
4. Month and year of manufacture
5. Wiring diagram
6. Product data
7. Programming mechanism if not integral to the APS

Submit 2 APS user and operator manuals for each signalized location as informational submittals. Each manual must have a master item index that includes:

1. Descriptions of the APS and its associated equipment and cables
2. Illustrative block diagrams

3. Manufacturer's contact information
4. Technical data specifications
5. Parts list, descriptions, and settings
6. Fault diagnostic and repair procedures
7. Preventative maintenance procedures for maintaining APS performance parameters

Submit the manufacturer's warranty documentation as an informational submittal before installing the APS.

Submit a record of completed field tests, the APS' final configuration, audible sound level and threshold, and a list of all parameter settings.

86-5.03A(4) Quality Control and Assurance

86-5.03A(4)(a) General

The APS must be compatible with the Department-furnished Model 170E/2070L controller assembly.

The power to the APS must be connected to the pedestrian signal's terminal blocks.

86-5.03A(4)(b) Functional Testing

Perform 2 field tests on the APS: (1) when traffic is noisy during peak traffic hours and (2) when traffic is quiet during off-peak hours. Notify the Engineer 15 days before testing the APS.

86-5.03A(4)(c) Warranty

The APS must have a 2-year manufacturer's warranty against any defects or failures. The 2-year warranty period starts at Contract acceptance. Deliver a replacement within 10 days after you receive notification of a failed APS. The Department does not pay for the replacement. Deliver the replacement to the Department's Maintenance Electrical Shop at:

Caltrans Escondido Maintenance Station,
1780 W. Mission Avenue, Escondido, CA,
Telephone (760) 746-2947,

86-5.03A(4)(d) Training

Provide a minimum of 8 hours of training by a certified manufacturer's representative for up to 5 Department employees selected by the Engineer. The training must include instruction in installing, programming, adjusting, calibrating, and maintaining the APS.

Furnish materials and equipment for the training.

86-5.03B Materials

The housing for the APS assembly must be made of corrosion-resistant material. Theftproof bolts used for mounting the APS housing to the standard must be stainless steel with a chromium content of 17 percent and a nickel content of 8 percent.

The color of metallic housing must match color no. 33538 of FED-STD-595.

The color of plastic housing must match color no. 17038, 27038, or 37038 of FED-STD-595.

The APS assembly must be rainproof and shockproof in any weather condition.

The APS assembly must include:

1. Pushbutton actuator with a minimum diameter of 2 inches. If a mechanical switch is used, it must have:
 - 1.1. Operating force of 3.5 lb
 - 1.2. Maximum pretravel of 5/64 inch
 - 1.3. Minimum overtravel of 1/32 inch
 - 1.4. Differential travel from 0.002 to 0.04 inch
2. Vibrotactile device on the pushbutton or on the arrow.

3. Enclosure with an ambient-sound-level-sensing microphone and weatherproof speaker. The enclosure must:
 - 3.1 Weigh less than 7 lb.
 - 3.2 Measure less than 16 by 6 by 5 inches.
 - 3.3 Fit the pole standard.
 - 3.4 Have a wiring hole with a diameter not exceeding 1-1/8 inches.
 - 3.5 Be attached to the pole with 2 screws with a diameter from 1/4 to 3/8 inch suitable for use in tapped holes. The clear space between any 2 holes in the post must be at least twice the diameter of the larger hole.
4. Pushbutton sign.

The APS speakers and electronic equipment must be installed inside the APS assembly's enclosure. The speaker grills must be located on the surface of the enclosure.

Speakers must not interfere with the housing or its mounting hardware.

The conductor cable between the APS assembly and the pedestrian signal head must be a no. 9, 20-conductor cable complying with MIL-W-16878D. The wiring must comply with section 13.02 of ITE publication *Equipment and Material Standards* chapter 2, "Vehicle Traffic Control Signal Heads," and be NEC rated for service at +105 degrees C.

The APS must:

1. Include a mechanism for enabling and disabling its operation.
2. Have electronic switches, a potentiometer, or a handheld device for controlling and programming the volume level and messaging. Deliver any handheld programming device to the Engineer.
2. Provide information using:
 - 2.1 Audible speech message that plays when the pushbutton is actuated. The message must include the name of the street to be crossed. The APS must have at least 5 audible message options. The Engineer selects the message. The message must have a percussive tone consisting of multiple frequencies with a dominant component of 880 Hz. If the tone is selected as the message, it must repeat 8 to 10 ticks per second.
 - 2.2. Pushbutton locator tone that clicks or beeps. The pushbutton must produce the locator tone at an interval of 1 tone per second. Each tone must have a maximum duration of 0.15 second. The tone volume must adjust in response to the ambient sound level and be audible up to 12 feet from the pushbutton or to the building line, whichever is less.
3. Have a pushbutton that remains functional during an APS failure.

For signalized intersections, the APS must:

1. Have a pushbutton that when actuated activates the pedestrian walk signal's timing during an APS failure.
2. Provide information using:
 - 2.1. Audible speech walk message. The message must be activated from the beginning of the walk interval and repeated for its duration. An example of the message is "Peachtree. Walk sign is on to cross Peachtree."
 - 2.2. Pushbutton information message that provides the name of the street to be crossed. The message must play when the pushbutton is actuated. An example of the message is "Wait to cross Howard at Grand. Wait."
3. Have a functional pushbutton that activates the pedestrian walk signal whenever actuated, even if the audible speech walk message, the pushbutton information message, the pushbutton locator tone, and the vibrating surface features are disabled.

86-5.03C Construction

Arrange to have a manufacturer's representative at the job site when the APS is installed and connected. The APS must not interfere with the Department-furnished controller assembly, the signal installation on signal standards, the pedestrian signal heads, or the terminal compartment blocks. The APS electronic control equipment must reside inside the APS assembly and the standard pedestrian signal head.

You are responsible for the compatibility of the components and for making the necessary calibration adjustments to deliver the performance specified. Furnish the equipment and hardware, and then set up, calibrate, and verify the performance of the APS.

Point arrows on the pushbutton signs in the same direction as the corresponding crosswalk. Attach the sign to the APS assembly.

86-5.03D Payment

Not Used

Replace section 86-6.02 with:

86-6.02 LED LUMINAIRES

86-6.02A General

86-6.02A(1) Summary

Section 86-6.02 includes specifications for installing LED luminaires.

86-6.02A(2) Definitions

CALiPER: Commercially Available LED Product Evaluation and Reporting. A U.S. DOE program that individually tests and provides unbiased information on the performance of commercially-available LED luminaires and lights.

correlated color temperature: Absolute temperature in kelvin of a blackbody whose chromaticity most nearly resembles that of the light source.

house side lumens: Lumens from a luminaire directed to light up areas between the fixture and the pole, such as sidewalks at intersection or areas off the shoulders on freeways.

International Electrotechnical Commission (IEC): Organization that prepares and publishes international standards for all electrical, electronic, and related technologies.

junction temperature: Temperature of the electronic junction of the LED device. The junction temperature is critical in determining photometric performance, estimating operational life, and preventing catastrophic failure of the LED.

L70: Extrapolated life in hours of the luminaire when the luminous output depreciates 30 percent from initial values.

LM-79: Test method from the Illumination Engineering Society of North America specifying test conditions, measurements, and report format for testing solid state lighting devices, including LED luminaires.

LM-80: Test method from the Illumination Engineering Society of North America specifying test conditions, measurements, and report format for testing and estimating the long-term performance of LEDs for general lighting purposes.

National Voluntary Laboratory Accreditation Program (NVLAP): U.S. DOE program that accredits independent testing laboratories.

power factor: Ratio of the real power component to the complex power component.

street side lumens: Lumens from a luminaire directed to light up areas between the fixture and the roadway, such as traveled ways and freeway lanes.

surge protection device (SPD): Subsystem or component that protects the unit against short-duration voltage and current surges.

total harmonic distortion: Ratio of the rms value of the sum of the squared individual harmonic amplitudes to the rms value of the fundamental frequency of a complex waveform.

86-6.02A(3) Submittals

Submit a sample luminaire to METS for testing after the manufacturer's testing is completed. Include the manufacturer's test data.

Product submittals must include:

1. LED luminaire checklist.
2. Product specification sheets, including:
 - 2.1. Maximum power in watts.
 - 2.2. Maximum designed junction temperature.
 - 2.3. Heat sink area in square inches.
 - 2.4. Designed junction to ambient thermal resistance calculation with thermal resistance components clearly defined.
 - 2.5. L70 in hours when extrapolated for the average nighttime operating temperature.
3. LM-79 and LM-80 compliant test reports from a CALiPER-qualified or NVLAP-approved testing laboratory for the specific model submitted.
4. Photometric file based on LM-79 test report.
5. Initial and depreciated isofootcandle diagrams showing the specified minimum illuminance for the particular application. The diagrams must be calibrated to feet and show a 40 by 40 foot grid. The diagrams must be calibrated to the mounting height specified for that particular application. The depreciated isofootcandle diagrams must be calculated at the minimum operational life.
6. Test report showing SPD performance as tested under ANSI/IEEE C62.41.2 and ANSI/IEEE C62.45.
7. Test report showing mechanical vibration test results as tested under California Test 611 or equal.
8. Data sheets from the LED manufacturer that include information on life expectancy based on junction temperature.
9. Data sheets from the power supply manufacturer that include life expectancy information.

Submit documentation of a production QA performed by the luminaire manufacturer that:

1. Ensures the minimum specified performance level
2. Includes a documented process for resolving problems

Submit the QA documentation as an informational submittal.

Submit the manufacturer's warranty documentation as an informational submittal before installing LED luminaires.

86-6.02A(4) Quality Control and Assurance

86-6.02A(4)(a) General

The Department may test random samples of the luminaires under section 86-2.14A. The Department tests luminaires under California Test 678 and may test any parameters specified in section 86-6.01.

Fit 1 sample luminaire with a thermistor or thermocouple temperature sensor. A temperature sensor must be mounted on the:

1. LED solder pad as close to the LED as possible
2. Power supply case
3. Light bar or modular system as close to the center of the module as possible

Other configurations must have at least 5 sensors per luminaire. The Engineer provides advice on sensor location. Thermocouples must be either Type K or C. Thermistors must be a negative-temperature-coefficient type with a nominal resistance of 20 k Ω . Use the appropriate thermocouple wire. The leads must be a minimum of 6 feet. Submit documentation with the test unit describing the type of sensor used.

Before performing any testing, energize the sample luminaires for a minimum of 24 hours at 100 percent on-time duty cycle and a temperature of +70 degrees F.

Depreciate the luminaire lighting's performance 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 lumen depreciation.

Failure of the luminaire that renders the unit noncompliant with section 86-6.02 specifications is cause for rejection.

86-6.02A(4)(b) Warranty

Provide a 7-year manufacturer's warranty against any defects or failures. The warranty period begins on the date of Contract acceptance. Furnish a replacement luminaire within 10 days after receipt of the failed luminaire. The Department does not pay for the replacement. Deliver replacement luminaires to the Department's Maintenance Electrical Shop at:

Caltrans Escondido Maintenance Station,
1780 W. Mission Avenue, Escondido, CA,
Telephone (760) 746-2947,

86-6.02B Materials

86-6.02B(1) General

The luminaire must include an assembly that uses LEDs as the light source. The assembly must include a housing, an LED array, and an electronic driver. The luminaire must:

1. Be UL listed under UL 1598 for luminaires in wet locations or an equivalent standard from a recognized testing laboratory
2. Have a minimum operational life of 63,000 hours
3. Operate at an average operating time of 11.5 hours per night
4. Be designed to operate at an average nighttime operating temperature of 70 degrees F
5. Have an operating temperature range from -40 to +130 degrees F
6. Be defined by the following applications:

Application	Replaces
Roadway 1	200 W high-pressure sodium luminaire mounted at 34 ft
Roadway 2	310 W high-pressure sodium luminaire mounted at 40 ft
Roadway 3	310 W high-pressure sodium luminaire mounted at 40 ft with back side control
Roadway 4	400 W high-pressure sodium luminaire mounted at 40 ft

The individual LEDs must be connected such that a catastrophic loss or a failure of 1 LED does not result in the loss of more than 20 percent of the luminous output of the luminaire.

86-6.02B(2) 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. Month and year of manufacture
6. Lot number
7. Contract number
8. Rated voltage
9. Rated wattage
10. Rated power in VA

86-6.02B(3) Electrical Requirements

The luminaire must operate from a 60 ± 3 Hz AC power source. The fluctuations of line voltage must have no visible effect on the luminous output. The operating voltage may range from 120 to 480 V(ac). The luminaire must operate over the entire voltage range or the voltage range must be selected from either of the following options:

1. Luminaire must operate over a voltage range of 95 to 277 V(ac). The operating voltages for this option are 120 V(ac) and 240 V(ac).
2. Luminaire must operate over a voltage range of 347 to 480 V(ac). The operating voltage for this option is 480 V(ac).

The power factor of the luminaire must be 0.90 or greater. The 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 must be as shown in the following table:

Application	Maximum consumption (watts)
Roadway 1	165
Roadway 2	235
Roadway 3	235
Roadway 4	300

86-6.02B(4) Surge Suppression and Electromagnetic Interference

The luminaire's on-board circuitry must include an SPD to withstand high repetition noise transients caused by utility line switching, nearby lightning strikes, and other interferences. The SPD must protect the luminaire from damage and failure due to transient voltages and currents as defined in Tables 1 and 4 of ANSI/IEEE C64.41.2 for location category C-High. The SPD must comply with UL 1449. The SPD must be tested under ANSI/IEEE C62.45 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 comply with the Class A emission limits under 47 CFR 15, subpart B, for the emission of electronic noise.

86-6.02B(5) Compatibility

The luminaire must be operationally compatible with currently-used lighting control systems and photoelectric controls.

86-6.02B(6) Photometric Requirements

The luminaire must maintain a minimum illuminance level throughout the minimum operating life. The L70 of the luminaire must be the minimum operating life or greater. The measurements must be calibrated to standard photopic calibrations. The minimum maintained illuminance values measured at a point must be as shown in the following table:

Application	Mounting height (ft)	Minimum maintained illuminance (fc)	Light pattern figure (isofootcandle curve)
Roadway 1	34	0.15	Pattern defined by an ellipse with the equation: where: x = direction longitudinal to the roadway y = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 20 feet to the house side of the pattern.
Roadway 2	40	0.2	Pattern defined by an ellipse with the equation: where: x = direction longitudinal to the roadway y = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 20 feet to the house side of the pattern.
Roadway 3	40	0.2	Pattern defined by an ellipse with the equation: for $y \geq 0$ (street side) where: x = direction longitudinal to the roadway y = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 20 feet to the house side of the pattern.
Roadway 4	40	0.2	Pattern defined by an ellipse with the equation: where: x = direction longitudinal to the roadway y = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 23 feet to the house side of the pattern.

The luminaire must have a correlated color temperature range from 3,500 to 6,500 K. The color rendering index must be 65 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

86-6.02B(7) Thermal Management

The passive thermal management of the heat generated by the LEDs must have enough capacity to ensure proper operation of the luminaire over the minimum operation life. The LED maximum junction temperature for the minimum operation life must not exceed 221 degrees F.

The junction-to-ambient thermal resistance must be 95 degrees F per watt or less. The use of fans or other mechanical devices is not allowed. The heat sink material must be aluminum or other material of equal or lower thermal resistance.

The luminaire must contain circuitry that automatically reduces the power to the LEDs so the maximum junction temperature is not exceeded when the ambient outside temperature is 100 degrees F or greater.

86-6.02B(8) Physical and Mechanical Requirements

The luminaire must:

1. Be a single, self-contained device not requiring job-site assembly for installation
2. Have an integral power supply
3. Weigh no more than 35 lb
4. Have a maximum-effective projected area of 1.4 sq ft when viewed from either side or end
5. Have a housing color that matches color number from 26152 to 26440, from 36231 to 36375, or 36440 of FED-STD-595.

The housing must be fabricated from materials designed to withstand a 3,000-hour salt spray test under ASTM B 117. All aluminum used in housings and brackets must be made of a marine-grade alloy with less than 0.2 percent copper. All exposed aluminum must be anodized.

Each refractor or lens must be made from UV-inhibited high-impact plastic such as acrylic or polycarbonate or heat- and impact-resistant glass and be resistant to scratching. Polymeric materials except lenses of enclosures containing either the power supply or electronic components of the luminaire must be made of UL94VO flame retardant materials. The housing's paint must comply with section 86-2.16. A chromate conversion undercoating must be used underneath a thermoplastic polyester powder coat.

Provide each housing with a slip fitter capable of mounting on a 2-inch pipe tenon. This slip fitter must fit on mast arms with outside diameters from 1-5/8 to 2-3/8 inches. The slip fitter must be capable of being adjusted a minimum of ±5 degrees from the axis of the tenon in a minimum of 5 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's mounting brackets must develop a permanent set in excess of 1/32 inch when the bracket's two or four 3/8-inch-diameter cap screws are tightened to 10 ft-lb. Two sets of cap screws may be furnished to allow the slip fitter to be mounted on the pipe tenon in the acceptable range without the cap screws bottoming out in the threaded holes. The cap screws and the clamping brackets must be made of corrosion-resistant materials or treated to prevent galvanic reactions and be compatible with the luminaire housing and the mast arm.

The LED luminaire must be assembled and manufactured such that its internal components are adequately supported to withstand mechanical shock and vibration from high winds and other sources. When tested under California Test 611, the luminaire to be mounted horizontally on the mast arm must be capable of withstanding the following cyclic loading for a minimum of 2 million cycles without failure of any luminaire part:

Cyclic Loading

Plane	Power supply	Minimum peak acceleration level
Vertical	Installed	3.0 g peak-to-peak sinusoidal loading (same as 1.5 g peak)
Horizontal ^a	Installed	1.5 g peak-to-peak sinusoidal loading (same as 0.75 g peak)

^aPerpendicular to the direction of the mast arm

The housing must be designed to prevent the buildup of water on top of the housing. Exposed heat sink fins must be oriented to allow water to freely run off of 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 to at least an ANSI/IEC rating of IP66. The power supply enclosure must be protected to at least an ANSI/IEC rating of IP43.

Furnish each mounted luminaire with an ANSI C136.10-compliant, locking-type photocontrol receptacle and a raintight shorting cap. The receptacle must comply with section 86-6.11A.

87-2.02 MATERIALS

87-2.02A General

Do not use air-cooled iron blast furnace slag to produce aggregate for:

1. Structure backfill material
2. Pervious backfill material
3. Permeable material
4. Reinforced or prestressed PCC component or structure
5. Nonreinforced PCC component or structure for which a Class 1 surface finish under section 51-1.03F(3) is required

Do not use aggregate produced from slag resulting from a steel-making process except in:

1. Imported borrow
2. AS
3. Class 2 AB
4. HMA

Steel slag used to produce aggregate for AS and Class 2 AB must be crushed such that 100 percent of the material will pass a 3/4-inch sieve and then control aged for 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.

For steel slag aggregate, provide separate stockpiles for controlled aging of the slag. An individual stockpile must not contain less than 10,000 tons or more than 50,000 tons of slag. The material in each individual stockpile must be assigned a unique lot number, and each stockpile must be identified with a permanent system of signs. Maintain a permanent record of:

1. Dates for:
 - 1.1. Completion of stockpile
 - 1.2. Start of controlled aging
 - 1.3. Completion of controlled aging
 - 1.4. Making of tests
2. Test results

For each stockpile of steel slag aggregate, moisture tests must be made at least once each week. The time covered by tests that show a moisture content of 6 percent or less is not included in the aging time.

Notify METS and the Engineer upon completion of each stockpile and the start of controlled aging and upon completion of controlled aging. Do not add aggregate to a stockpile unless a new aging period is started.

Steel slag used for imported borrow must be weathered for at least 3 months.

Each delivery of aggregate containing steel slag for AS or Class 2 AB must include a delivery tag for each load. The tag must identify the lot by the stockpile number, slag aging location, and stockpile completion and controlled aging start date.

You may blend air-cooled iron blast furnace slag or natural aggregate in proper combinations with steel slag aggregate to produce the specified gradings.

California Test 202 is modified by California Test 105 whenever the difference in sp gr between the coarse and fine portions of the aggregate or between the blends of different aggregates is 0.2 or more.

For slag used as aggregate in HMA, the Kc factor requirements in California Test 303 do not apply.

If steel slag aggregates are used to produce HMA, no other aggregates may be 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, natural aggregates, or a combination of these. If iron blast furnace aggregates, natural aggregates, or a combination of these are used in the mixture, each aggregate type must be fed to the drier at a uniform rate. Maintain the feed rate of each aggregate type within 10 percent of the amount set. Provide adequate means for controlling and checking the feeder accuracy.

Store steel slag aggregate separately from iron blast furnace slag aggregate. Store each slag aggregate type separately from natural aggregate.

For HMA produced from steel slag aggregates, iron blast furnace slag aggregates, natural aggregates, or any combination of these, the same aggregate must be used throughout any one layer. Once an aggregate type is selected, do not change it without authorization.

Aggregate containing slag must comply with the applicable quality requirements for the bid items in which the aggregate is used.

87-2.03 CONSTRUCTION

Do not place aggregate produced from slag within 1 foot of a non-cathodically protected pipe or structure unless the aggregate is incorporated in concrete pavement, in HMA, or in treated base.

Do not place slag aggregate used for embankments within 18 inches of finished slope lines measured normal to the plane of the slope.

Whenever slag aggregate is used for imported borrow, place a layer of topsoil at least 36 inches thick after compaction over the slag aggregate in highway planting areas.

87-2.04 PAYMENT

The Department reduces the payment quantity of HMA if:

- 1. Steel slag aggregates are used to produce HMA
- 2. The sp gr of a compacted stabilometer test specimen is in excess of 2.40

The Department prepares the stabilometer test specimen under California Test 304 and determines the sp gr of the specimen under Method C of California Test 308.

The Department determines the HMA payment quantity by multiplying the quantity of HMA placed in the work by 2.40 and dividing the result by the sp gr of the compacted stabilometer test specimen. The Department applies this quantity reduction as often as necessary to ensure accurate results.

AA

88 GEOSYNTHETICS

Add to section 88-1.02B:

Filter fabric for gravel backfill at the timber retaining walls must be Class A.

AA

90 CONCRETE

Add to section 90-2.02B:

You may use rice hull ash as an SCM. Rice hull ash must comply with AASHTO M 321 and the chemical and physical requirements shown in the following tables:

Chemical property	Requirement (percent)
Silicon dioxide (SiO ₂) ^a	90 min
Loss on ignition	5.0 max
Total alkalis as Na ₂ O equivalent	3.0 max

Physical property	Requirement
Particle size distribution	
Less than 45 microns	95 percent
Less than 10 microns	50 percent
Strength activity index with portland cement ^b	
7 days	95 percent (min percent of control)
28 days	110 percent (min percent of control)
Expansion at 16 days when testing project materials under ASTM C 1567 ^c	0.10 percent max
Surface area when testing by nitrogen adsorption under ASTM D 5604	40.0 m ² /g min

^aSiO₂ in crystalline form must not exceed 1.0 percent.

^bWhen tested under AASHTO M 307 for strength activity testing of silica fume.

^cIn the test mix, Type II or V portland cement must be replaced with at least 12 percent rice hull ash by weight.

For the purpose of calculating the equations for the cementitious material specifications, consider rice hull ash to be represented by the variable *UF*.

**REVISED STANDARD SPECIFICATIONS
APPLICABLE TO THE 2010 EDITION
OF THE STANDARD SPECIFICATIONS**

Add to the 1st table in section 1-1.06:

04-19-13

LCS	Department's lane closure system
POC	pedestrian overcrossing
QSD	qualified SWPPP developer
QSP	qualified SWPPP practitioner
TRO	time-related overhead
WPC	water pollution control

Delete the abbreviation and its meaning for *UDBE* in the 1st table of section 1-1.06.

06-20-12

Delete "Contract completion date" and its definition in section 1-1.07B.

10-19-12

Delete "critical delay" and its definition in section 1-1.07B.

10-19-12

Replace "day" and its definition in section 1-1.07B with:

10-19-12

day: 24 consecutive hours running from midnight to midnight; calendar day.

1. **business day:** Day on the calendar except a Saturday and a holiday.
2. **working day:** Time measure unit for work progress. A working day is any 24-consecutive-hour period except:
 - 2.1. Saturday and holiday.
 - 2.2. Day during which you cannot perform work on the controlling activity for at least 50 percent of the scheduled work shift with at least 50 percent of the scheduled labor and equipment due to any of the following:
 - 2.2.1. Adverse weather-related conditions.
 - 2.2.2. Maintaining traffic under the Contract.
 - 2.2.3. Suspension of a controlling activity that you and the Engineer agree benefits both parties.
 - 2.2.4. Unanticipated event not caused by either party such as:
 - 2.2.4.1. Act of God.
 - 2.2.4.2. Act of a public enemy.
 - 2.2.4.3. Epidemic.
 - 2.2.4.4. Fire.
 - 2.2.4.5. Flood.
 - 2.2.4.6. Governor-declared state of emergency.
 - 2.2.4.7. Landslide.
 - 2.2.4.8. Quarantine restriction.
 - 2.2.5. Issue involving a third party, including:
 - 2.2.5.1. Industry or area-wide labor strike.
 - 2.2.5.2. Material shortage.
 - 2.2.5.3. Freight embargo.
 - 2.2.5.4. Jurisdictional requirement of a law enforcement agency.
 - 2.2.5.5. Workforce labor dispute of a utility or nonhighway facility owner resulting in a nonhighway facility rearrangement not described and not solely for the Contractor's convenience. Rearrangement of a nonhighway facility includes installation, relocation, alteration, or removal of the facility.
 - 2.3. Day during a concurrent delay.
3. **original working days:**

- 3.1. Working days to complete the work shown on the *Notice to Bidders* for a non-cost plus time based bid.
- 3.2. Working days bid to complete the work for a cost plus time based bid.

Where working days is specified without the modifier "original" in the context of the number of working days to complete the work, interpret the number as the number of original working days as adjusted by any time adjustment.

Replace "Contract" in the definition of "early completion time" in section 1-1.07B with:

work

10-19-12

Replace "excusable delay" and its definition in section 1-1.07B with:

delay: Event that extends the completion of an activity.

10-19-12

1. **excusable delay:** Delay caused by the Department and not reasonably foreseeable when the work began such as:
 - 1.1. Change in the work
 - 1.2. Department action that is not part of the Contract
 - 1.3. Presence of an underground utility main not described in the Contract or in a location substantially different from that specified
 - 1.4. Described facility rearrangement not rearranged as described, by the utility owner by the date specified, unless the rearrangement is solely for the Contractor's convenience
 - 1.5. Department's failure to obtain timely access to the right-of-way
 - 1.6. Department's failure to review a submittal or provide notification in the time specified
2. **critical delay:** Excusable delay that extends the scheduled completion date
3. **concurrent delay:** Occurrence of at least 2 of the following events in the same period of time, either partially or entirely:
 - 3.1. Critical delay
 - 3.2. Delay to a controlling activity caused by you
 - 3.3. Non-working day

Replace "project" in the definition of "scheduled completion date" in section 1-1.07B with:

work

10-19-12

Add to section 1-1.07B:

Contract time: Number of original working days as adjusted by any time adjustment.

10-19-12

Disadvantaged Business Enterprise: Disadvantaged Business Enterprise as defined in 49 CFR 26.5.

06-20-12

Replace "PO BOX 911" in the District 3 mailing address in the table in section 1-1.08 with:

703 B ST

04-20-12

Replace the Web site for the Department of General Services, Office of Small Business and DVBE Services in the table in section 1-1.11 with:

11-15-13

<http://www.dgs.ca.gov/dgs/ProgramsServices/BusServices.aspx>

AA

2 BIDDING

02-21-14

Replace the headings and paragraphs in section 2 with:

02-21-14

2-1.01 GENERAL

Section 2 includes specifications related to bid eligibility and the bidding process.

The electronic bid specifications in section 2 apply if *Electronic Bidding Contract* is shown on the cover of the *Notice to Bidders and Special Provisions*.

2-1.02 BID INELIGIBILITY

A firm that has provided architectural or engineering services to the Department for this contract before bid submittal for this contract is prohibited from any of the following:

1. Submitting a bid
2. Subcontracting for a part of the work
3. Supplying materials

2-1.03–2-1.05 RESERVED

2-1.06 BID DOCUMENTS

2-1.06A General

Standard Specifications and *Standard Plans* may be viewed at the Bidders' Exchange website and may be purchased at the Publication Distribution Unit.

The *Notice to Bidders and Special Provisions* and project plans may be viewed at the Bidders' Exchange website and at the street address.

Bid books may be ordered at the Bidders' Exchange website.

For an informal-bid contract, in addition to viewing and ordering them as specified above, the *Notice to Bidders and Special Provisions*, project plans, and *Bid* book may be obtained at the Bidders' Exchange street address.

The *Notice to Bidders and Special Provisions* includes the *Notice to Bidders*, revised standard specifications, and special provisions.

2-1.06B Supplemental Project Information

The Department makes supplemental information available as specified in the special provisions.

Logs of test borings are supplemental project information.

If an *Information Handout* or cross sections are available:

1. You may view them at the Contract Plans and Special Provisions link at the Bidders' Exchange website
2. For an informal-bid contract, you may obtain them at the Bidders' Exchange street address

If rock cores are available, you may view them by sending a request to Coreroom@dot.ca.gov.

If other supplemental project information is available for inspection, you may view it by phoning in a request.

Make your request at least 7 days before viewing. Include in your request:

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 they 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.

2-1.06C–2-1.06D Reserved

2-1.07 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

2-1.08 RESERVED

2-1.09 BID ITEM LIST

Submit a bid based on the bid item quantities the Department shows on the Bid Item List.

2-1.10 SUBCONTRACTOR LIST

On the Subcontractor List form, 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 form must show the name, address, and work portions to be performed by each subcontractor listed. Show work portions by bid item number, description, and percentage of each bid item subcontracted.

2-1.11 RESERVED

2-1.12 DISADVANTAGED BUSINESS ENTERPRISES

2-1.12A General

Section 2-1.12 applies to a federal-aid contract.

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).

2-1.12B Disadvantaged Business Enterprise Goal

2-1.12B(1) General

Section 2-1.12B applies if a DBE goal is shown on the *Notice to Bidders*.

To ensure equal participation of DBEs provided in 49 CFR 26.5, the Department shows a goal for DBEs.

Make work available to DBEs and select work parts consistent with available DBE subcontractors and suppliers.

Meet the DBE goal shown on the *Notice to Bidders* or demonstrate that you made adequate good faith efforts to meet this goal.

You are responsible to verify that the at the bid opening date the DBE firm is certified as DBE by the CA Unified Certification Program.

All DBE participation will count toward the Department's federally-mandated statewide overall DBE goal.

Credit for materials or supplies you purchase from DBEs counts toward the goal in the following manner:

1. 100 percent if the materials or supplies are obtained from a DBE manufacturer.
2. 60 percent if the materials or supplies are obtained from a DBE regular dealer.
3. Only fees, commissions, and charges for assistance in the procurement and delivery of materials or supplies, if they are obtained from a DBE that is neither a manufacturer nor regular dealer. 49 CFR 26.55 defines "manufacturer" and "regular dealer."

You receive credit toward the goal if you employ a DBE trucking company that performs a commercially useful function as defined in 49 CFR 26.55(d)(1)–(4), (6).

2-1.12B(2) DBE Commitment Submittal

Submit DBE information under section 2-1.33.

Bidders other than the apparent low bidder, the 2nd low bidder, and the 3rd low bidder are not required to submit the DBE commitment form unless the Department requests it. If the Department requests a DBE commitment form from you, submit the completed form within 4 business days of the request.

Submit written confirmation from each DBE shown on the form stating that it will be participating in the Contract. Include confirmation with the DBE commitment form. A copy of a DBE's quote will serve as written confirmation that the DBE will be participating in the Contract.

2-1.12B(3) Good Faith Efforts Submittal

If you have not met the DBE goal, complete and submit the Good Faith Efforts Documentation under section 2-1.33 showing that you made adequate good faith efforts to meet the goal. Only good faith efforts directed toward obtaining participation by DBEs are considered.

If your DBE commitment form shows that you have met the DBE goal or if you are required to submit the DBE commitment form, you must 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 DBE goal has not been met.

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

2-1.13–2-1.14 RESERVED

2-1.15 DISABLED VETERAN BUSINESS ENTERPRISES

2-1.15A General

Section 2-1.15 applies to a non-federal-aid contract.

Take necessary and reasonable steps to ensure that DVBEs have opportunity to participate in the Contract.

Comply with Mil & Vet Code § 999 et seq.

2-1.15B Projects \$5 Million or Less

Section 2-1.15B applies to a project with an estimated cost of \$5 million or less.

Make work available to DVBEs and select work parts consistent with available DVBE subcontractors and suppliers.

Meet the goal shown on the *Notice to Bidders*.

Complete and submit the Certified DVBE Summary form under section 2-1.33. List all DVBE participation on this form.

If a DVBE joint venture is used, submit the joint venture agreement with the Certified DVBE Summary form.

List each 1st-tier DVBE subcontractor on the Subcontractor List form regardless of percentage of the total bid.

2-1.15C Projects More Than \$5 Million

2-1.15C(1) General

Section 2-1.15C applies to a project with an estimated cost of more than \$5 million.

The Department encourages bidders to obtain DVBE participation to ensure the Department achieves its State-mandated overall DVBE goal.

If you obtain DVBE participation:

1. Complete and submit the Certified DVBE Summary form under section 2-1.33. List all DVBE participation on this form.
2. List each 1st tier DVBE subcontractor in the Subcontractor List form regardless of percentage of the total bid.

If a DVBE joint venture is used, submit the joint venture agreement with the Certified DVBE Summary form.

2-1.15C(2) DVBE Incentive

The Department grants a DVBE incentive to each bidder who achieves a DVBE participation of 1 percent or greater (Mil & Vet Code 999.5 and Code of Regs § 1896.98 et seq.).

To receive this incentive, submit the Certified DVBE Summary form under section 2-1.33.

Bidders other than the apparent low bidder, the 2nd low bidder, and the 3rd low bidder may be required to submit the Certified DVBE Summary form if the bid ranking changes. If the Department requests a Certified DVBE Summary form from you, submit the completed form within 4 business days of the request.

2-1.15C(3) Incentive Evaluation

The Department applies the small business and non–small business preference during bid verification and proceeds with the evaluation specified below for DVBE incentive.

The DVBE incentive is a reduction, for bid comparison only, in the total bid submitted by the lesser of the following amounts:

1. Percentage of DVBE achievement rounded to 2 decimal places of the verified total bid of the low bidder
2. 5 percent of the verified total bid of the low bidder
3. \$250,000

The Department applies DVBE incentive and determines whether bid ranking changes.

A non–small business bidder cannot displace a small business bidder. However, a small business bidder with higher DVBE achievement can displace another small business bidder.

The Department proceeds with awarding the contract to the new low bidder and posts the new verified bid results at the Department's Web site.

2-1.16–2-1.17 RESERVED

2-1.18 SMALL BUSINESS AND NON–SMALL BUSINESS SUBCONTRACTOR PREFERENCES

2-1.18A General

Section 2-1.18 applies to a non-federal-aid contract.

The Department applies small business preferences and non–small business preferences under Govt Code § 14835 et seq. and 2 CA Code of Regs § 1896 et seq.

Any contractor, subcontractor, supplier, or service provider who qualifies as a small business is encouraged to apply for certification as a small business by submitting its application to the Department of General Services, Office of Small Business and DVBE Services.

Contract award is based on the total bid, not the reduced bid.

2-1.18B Small Business Preference

The Department allows a bidder certified as a small business by the Department of General Services, Office of Small Business and DVBE Services, a preference if:

1. Bidder submitted a completed Request for Small Business Preference or Non–Small Business Preference form with its bid
2. Low bidder did not request the preference or is not certified as a small business

The bidder's signature on the Request for Small Business Preference or Non–Small Business Preference form certifies that the bidder is certified as a small business at the date and time of bid or has submitted a complete application to the Department of General Services. The complete application and any required substantiating documentation must be received by the Department of General Services by 5:00 p.m. on the bid opening date.

The Department of General Services determines whether a bidder was certified on the bid opening date. The Department of Transportation confirms the bidder's status as a small business before applying the small business preference.

The small business preference is a reduction for bid comparison in the total bid submitted by the small business contractor by the lesser of the following amounts:

1. 5 percent of the verified total bid of the low bidder
2. \$50,000

If the Department determines that a certified small business bidder is the low bidder after the application of the small business preference, the Department does not consider a request for non–small business preference.

2-1.18C Non–Small Business Subcontractor Preference

The Department allows a bidder not certified as a small business by the Department of General Services, Office of Small Business and DVBE Services, a preference if:

1. Bidder submitted a completed Request for Small Business Preference or Non–Small Business Preference form with its bid
2. Certified Small Business Listing for the Non–Small Business Preference form shows that you are subcontracting at least 25 percent to certified small businesses

Each listed subcontractor and supplier must be certified as a small business at the date and time of bid or must have submitted a complete application to the Department of General Services. The complete application and any required substantiating documentation must be received by the Department of General Services by 5:00 p.m. on the bid opening date.

The non–small business subcontractor preference is a reduction for bid comparison in the total bid submitted by the non–small business contractor requesting the preference by the lesser of the following amounts:

1. 5 percent of the verified total bid of the low bidder
2. \$50,000

2-1.19–2-1.26 RESERVED

2-1.27 CALIFORNIA COMPANIES

Section 2-1.27 applies to a non-federal-aid contract.

Under Pub Cont Code § 6107, the Department gives preference to a "California company," as defined, for bid comparison purposes over a nonresident contractor from any state that gives or requires a preference to be given to contractors from that state on its public entity construction contracts.

Complete a California Company Preference form.

The California company reciprocal preference amount is equal to the preference amount applied by the state of the nonresident contractor with the lowest responsive bid unless the California company is eligible for a small business preference or a non–small business subcontractor preference, in which case the preference amount is the greater of the two, but not both.

If the low bidder is not a California company and a California company's bid with reciprocal preference is equal to or less than the lowest bid, the Department awards the contract to the California company on the basis of its total bid.

2-1.28 RESERVED

2-1.29 OPT OUT OF PAYMENT ADJUSTMENTS FOR PRICE INDEX FLUCTUATIONS

You may opt out of the payment adjustments for price index fluctuations specified in section 9-1.07. To opt out, submit a completed Opt Out of Payment Adjustments for Price Index Fluctuations form under section 2-1.33.

2-1.30–2-1.32 RESERVED

2-1.33 BID DOCUMENT COMPLETION AND SUBMITTAL

Complete forms in the *Bid* book.

For a paper bid, submit your bid:

1. Under sealed cover
2. Marked as a bid
3. Identifying the contract number and the bid opening date

For an electronic bid, complete and submit the *Bid* book under the *Electronic Bidding Guide* at the Bidders' Exchange website.

Submit the forms and form information at the times shown in the following table:

Bid Form Submittal Schedule				
Contract type	Forms to be submitted at the time of bid	Forms to be submitted no later than 24 hours after bid opening ^a	Forms to be submitted no later than 4 p.m. on the 2nd business day after bid opening ^a	Forms to be submitted no later than 4 p.m. on the 4th business day after bid opening ^a
All contracts	<ul style="list-style-type: none"> • Bid to the Department of Transportation • Business name and location; description of subcontracted work on the Subcontractor List • Opt Out of Payment Adjustments for Price Index Fluctuations^c 	<ul style="list-style-type: none"> • Bid item nos. and percentage of bid item subcontracted on the SubcontractorList^b 	--	--
Non-federal-aid contracts only	<ul style="list-style-type: none"> • California Company Preference • Request for Small Business Preference or Non-Small Business Preference^c 	--	<ul style="list-style-type: none"> • Certified Small Business Listing for the Non-Small Business Preference^c 	<ul style="list-style-type: none"> • Certified DVBE Summary^d
Federal-aid contracts only	<ul style="list-style-type: none"> • Small Business Status 	--	--	<ul style="list-style-type: none"> • Caltrans Bidder - DBE - Commitment^e • Good Faith Efforts Documentation - DBE^f

^aThe forms and information may be submitted at the time of bid.

^bIf the information is not submitted at the time of bid, fax it to (916) 227-6282. This after-bid submittal does not apply to an informal-bid contract. For an informal bid contract, submit the completed form at the time of bid.

^cApplicable only if the preference or option is chosen.

^dNot applicable to an informal-bid contract or a project with an estimated cost of more than \$5 million. For an informal bid contract, submit the completed form at the time of bid. For a project with an estimated cost of more than \$5 million, applicable only if you obtain DVBE participation or you are the apparent low bidder, 2nd low bidder, or 3rd low bidder and you choose to receive the specified incentive.

^eIf not submitted at the time of bid, applicable only to the apparent low bidder, 2nd low bidder, and 3rd low bidder.

^fApplicable only if you have not met the DBE goal.

For an electronic bid:

1. Forms to be submitted at the time of bid must be submitted as described in the *Electronic Bidding Guide* or faxed to (916) 227-6282 before the bid opening date and time.
2. Your authorized digital signature is your confirmation of and agreement to all certifications and statements contained in the *Bid* book.
3. On forms and certifications that you submit through the electronic bidding service, you agree that each form and certification where a signature is required is deemed as having your signature. On forms that you submit after bid opening, sign the forms where a signature is required in ink.

Failure to submit the forms and information as specified results in a nonresponsive bid.

If an agent other than the authorized corporation officer or a partnership member signs the bid, file a Power of Attorney with the Department either before opening bids or with the bid. Otherwise, the bid may be nonresponsive.

2-1.34 BIDDER'S SECURITY

Submit 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. Signed bidder's bond by an admitted surety insurer
5. For an electronic bid, electronic bidder's bond by an admitted surety insurer submitted using an electronic registry service approved by the Department.

Submit cash, cashier's check, certified check, or bidder's bond to the Department at the Bidders Exchange before the bid opening time.

Submit electronic bidder's bond with the electronic bid.

If using a bidder's bond, you may use the form in the *Bid* book. If you do not use the form in the *Bid* book, use a form containing the same information.

2-1.35–2-1.39 RESERVED

2-1.40 BID WITHDRAWAL

For a paper bid:

1. An authorized agent may withdraw a bid before the bid opening date and time by submitting a written bid withdrawal request at the location where the bid was submitted. Withdrawing a bid does not prevent you from submitting a new bid.
2. After the bid opening time, you cannot withdraw a bid.

For an electronic bid:

1. Bids are not filed with the Department until the date and time of bid opening.
2. A bidder may withdraw or revise a bid after it has been submitted to the electronic bidding service if this is done before the bid opening date and time.

2-1.41–2-1.42 RESERVED

2-1.43 BID OPENING

The Department publicly opens and reads bids at the time and place shown on the *Notice to Bidders*.

2-1.44–2-1.45 RESERVED

2-1.46 DEPARTMENT'S DECISION ON BID

The Department's decision on the bid amount is final.

The Department may reject:

1. All bids
2. A nonresponsive bid

2-1.47 BID RELIEF

The Department may grant bid relief under Pub Cont Code § 5100 et seq. Submit any request for bid relief to the Office Engineer. The Relief of Bid Request form is available at the Department's website.

2-1.48 RESERVED

2-1.49 SUBMITTAL FAILURE HISTORY

The Department considers a bidder's past failure to submit documents required after bid opening in determining a bidder's responsibility.

2-1.50 BID RIGGING

Section 2-1.50 applies to a federal-aid contract.

The U.S. Department of Transportation (DOT) provides a toll-free hotline to report bid rigging activities. Use the hotline to report bid rigging, bidder collusion, and other fraudulent activities. The hotline number is (800) 424-9071. The service is available 24 hours 7 days a week and is confidential and anonymous.. The hotline is part of the DOT's effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General.

AA

3 CONTRACT AWARD AND EXECUTION

02-21-14

Replace section 3-1.02 with:

02-21-14

3-1.02 CONSIDERATION OF BIDS

3-1.02A General

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.

3-1.02B Tied Bids

The Department breaks a tied bid with a coin toss except:

- 1. If a small business bidder and a non-small business bidder request preferences and the reductions result in a tied bid, the Department awards the contract to the small business bidder.
- 2. If a DVBE small business bidder and a non-DVBE small business bidder request preferences and the reduction results in a tied bid, the Department awards the contract to the DVBE small business bidder.

Add to the end of section 3-1.04:

10-19-12

You may request to extend the award period by faxing a request to (916) 227-6282 before 4:00 p.m. on the last day of the award period. If you do not make this request, after the specified award period:

- 1. Your bid becomes invalid
- 2. You are not eligible for the award of the contract

Replace the paragraph in section 3-1.11 with:

10-19-12

Complete and deliver to the Office Engineer a *Payee Data Record* when requested by the Department.

Replace section 3-1.13 with:

07-27-12

3-1.13 FORM FHWA-1273

For a federal-aid contract, form FHWA-1273 is included with the Contract form in the documents sent to the successful bidder for execution. Comply with its provisions. Interpret the training and promotion section as specified in section 7-1.11A.

Replace "90" in the last sentence of the 7th paragraph of section 5-1.13B(1) with:

06-20-12

30

Replace "Underutilized" in "Underutilized Disadvantaged Business Enterprises" in the heading of section 5-1.13B(2) with:

06-20-12

Performance of

Delete *U* in *UDBE* at each occurrence in section 5-1.13B(2).

06-20-12

Replace the 3rd paragraph of section 5-1.13B(2) with:

06-20-12

Do not terminate or substitute a listed DBE for convenience and perform the work with your own forces or obtain materials from other sources without authorization from the Department.

Replace item 6 in the list in the 4th paragraph of section 5-1.13B(2) with:

06-20-12

6. Listed DBE is ineligible to work on the project because of suspension or debarment.

Add to the list in the 4th paragraph of section 5-1.13B(2):

06-20-12

8. Listed DBE voluntarily withdraws with written notice from the Contract.
9. Listed DBE is ineligible to receive credit for the type of work required.
10. Listed DBE owner dies or becomes disabled resulting in the inability to perform the work on the Contract.
11. Department determines other documented good cause.

Add between the 4th and 5th paragraphs of section 5-1.13B(2):

07-20-12

Notify the original DBE of your intent to use other forces or material sources and provide the reasons. Provide the DBE with 5 days to respond to your notice and advise you and the Department of the reasons why the use of other forces or sources of materials should not occur. Your request to use other forces or material sources must include:

1. 1 or more of the reasons listed in the preceding paragraph
2. Notices from you to the DBE regarding the request
3. Notices from the DBE to you regarding the request

Add between "terminated" and ", you" in the 5th paragraph of section 5-1.13B(2):

07-20-12

or substituted

Replace the paragraphs of section 5-1.13C with:

11-15-13

Section 5-1.13C applies to a non-federal-aid contract.

Use each DVBE as shown on the *Certified DVBE Summary* form unless you receive authorization from the Department for a substitution. The substitute must be another DVBE unless DVBEs are not available, in which case, you must substitute with a small business. Any authorization for a substitute is contingent upon the Department of General Services' approval of the substitute.

The requirement that DVBEs be certified by the bid opening date does not apply to DVBE substitutions after Contract award.

The Department authorizes substitutions for any of the reasons provided in 2 CA Code of Regs § 1896.73.

Include in your substitution request:

1. Copy of the written notice issued to the DVBE with proof of delivery
2. Copy of the DVBE's response to the notice
3. Name and certification number of the listed DVBE and the proposed substitute

Requests for substitutions of a listed DVBE with a small business must include documentation of the unavailability of DVBEs, including:

1. Contact with the small business/DVBE advocate from the Department and the Department of Veterans Affairs
2. Search results from the Department of General Services' website of available DVBEs
3. Communication with a DVBE community organization nearest the job site, if applicable
4. Documented communication with the DVBE and small businesses describing the work to be performed, the percentage of the total bid, the corresponding dollar amount, and the responses to the communication

The Department forwards your substitution request to the Department of General Services. The Department of General Services issues a notice of approval or denial. The Department provides you this notice.

If you fail to use a listed DVBE without an authorized substitution request, the Department issues a penalty of up to 10 percent of the dollar amount of the work of the listed DVBE.

Maintain records of subcontracts made with DVBEs. Include in the records:

1. Name and business address of each business
2. Total amount paid to each business

For the purpose of determining compliance with Pub Cont Code § 10115 et seq.:

1. Upon work completion, complete and submit *Final Report - Utilization of Disabled Veteran Business Enterprises (DVBE) State Funded Projects Only* form.
2. Upon reasonable notice and during normal business hours, permit access to its premises for the purposes of:
 - 2.1. Interviewing employees.
 - 2.2. Inspecting and copying books, records, accounts and other material that may be relevant to a matter under investigation.

Replace "Reserved" in section 5-1.20C with:

10-19-12

If the Contract includes an agreement with a railroad company, the Department makes the provisions of the agreement available in the *Information Handout* in the document titled "Railroad Relations and Insurance Requirements." Comply with the requirements in the document.

Add between the 2nd and 3rd paragraphs of section 5-1.23A:

10-19-12

Submit action and informational submittals to the Engineer.

Add between the 5th and 6th paragraphs of section 5-1.23B(1):

07-19-13

For a revised submittal, allow the same number of days for review as for the original submittal.

Delete the 1st sentence in the 10th paragraph of section 5-1.23B(2).

07-19-13

Add to the list in the 1st paragraph of section 5-1.36A:

07-19-13

10. Survey monuments

Add to section 5-1.36C:

07-20-12

If the Contract does not include an agreement with a railroad company, do not allow personnel or equipment on railroad property.

Prevent material, equipment, and debris from falling onto railroad property.

Add to section 5-1.36:

07-19-13

5-1.36E Survey Monuments

Protect survey monuments on and off the highway. Upon discovery of a survey monument not identified and located immediately:

1. Stop work near the monument
2. Notify the Engineer

Do not resume work near the monument until authorized.

Add between the 1st and 2nd paragraphs of section 5-1.37A:

10-19-12

Do not remove any padlock used to secure a portion of the work until the Engineer is present to replace it. Notify the Engineer at least 3 days before removing the lock.

Replace the 1st sentence of the 1st paragraph of section 5-1.39C(2) with:

10-19-12

Section 5-1.39C(2) applies if a plant establishment period of 3 years or more is shown on the *Notice to Bidders*.

Replace "90 days" in the 14th paragraph of section 7-1.04 with:

09-16-11

125 days

Add between the 18th and 19th paragraphs of section 7-1.04:

09-16-11

Temporary facilities that could be a hazard to public safety if improperly designed must comply with design requirements described in the Contract for those facilities or, if none are described, with standard design criteria or codes appropriate for the facility involved. Submit shop drawings and design calculations for the temporary facilities and show the standard design criteria or codes used. Shop drawings and supplemental calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State.

Replace the 2nd paragraph of section 7-1.11A with:

07-27-12

A copy of form FHWA-1273 is included in section 7-1.11B. The training and promotion section of section II refers to training provisions as if they were included in the special provisions. The Department specifies the provisions in section 7-1.11D of the *Standard Specifications*. If a number of trainees or apprentices is required, the Department shows the number on the *Notice to Bidders*. Interpret each FHWA-1273 clause shown in the following table as having the same meaning as the corresponding Department clause:

FHWA-1273 Nondiscrimination Clauses

FHWA-1273 section	FHWA-1273 clause	Department clause
Training and Promotion	In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision.	If section 7-1.11D applies, section 7-1.11D supersedes this subparagraph.
Records and Reports	If on-the-job training is being required by special provision, the contractor will be required to collect and report training data.	If the Contract requires on-the-job training, collect and report training data.

Replace the form in section 7-1.11B with:

07-20-12

**REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS**

- I. General
- II. Nondiscrimination
- III. Nonsegregated Facilities
- IV. Davis-Bacon and Related Act Provisions
- V. Contract Work Hours and Safety Standards Act Provisions
- VI. Subletting or Assigning the Contract
- VII. Safety: Accident Prevention
- VIII. False Statements Concerning Highway Projects
- IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
- X. Compliance with Governmentwide Suspension and Debarment Requirements
- XI. Certification Regarding Use of Contract Funds for Lobbying

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under Title 23 (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services). The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in bid proposal or request for proposal documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract).

2. Subject to the applicability criteria noted in the following sections, 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.

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors.

II. NONDISCRIMINATION

The provisions of this section related to 23 CFR Part 230 are applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR 60, 29 CFR 1625-1627, Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding \$10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR 60, and 29 CFR 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), and Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR 230, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

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, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 27) 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 provisions of the Americans with 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 contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract.

b. The contractor will accept as its 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, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program 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 minorities and women.

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 minorities and women 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 minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority and women 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, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such 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 its 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 their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are

applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

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. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

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 employees who are minorities and women 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 good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. 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 good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith 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 contracting agency 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 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 minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar

with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established there under. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. 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. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurance Required by 49 CFR 26.13(b):

a. The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.

b. The contractor 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 contracting agency deems appropriate.

11. 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 the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours 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; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women;

b. The contractors and subcontractors will submit an annual report to the contracting agency 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](#). The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor

will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more.

The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding \$2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size). The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 "Contract provisions and related matters" with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages

a. All laborers and mechanics 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 issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions

of paragraph 1.d. of this section; also, 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 29 CFR 5.5(a)(4). 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. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH-1321) 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.

b. (1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the contractor and the laborers and mechanics to be employed in the classification (if known), 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 Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The 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.

(3) In the event the contractor, the laborers or mechanics to be employed in the 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. The Wage and Hour 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.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

c. 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 shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

d. If the contractor does not make payments to a trustee or other third person, the contractor may consider as 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.

2. Withholding

The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor 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, so 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 contracting agency 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.

3. Payrolls and basic records

a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of 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. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) 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 shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b. (1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency..

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(ii) That each 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 Regulations, 29 CFR part 3;

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) 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 3.b.(2) of this section.

(4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, 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 FHWA may, after written notice to the contractor, the contracting agency or the State DOT, take such action 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.

4. Apprentices and trainees

a. Apprentices (programs of the USDOL).

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 U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or 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 Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

The allowable ratio of apprentices to journeymen 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 worker 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 on 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 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's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

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 journeymen 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 determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

b. Trainees (programs of the USDOL).

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 U.S. Department of Labor, Employment and Training Administration.

The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman 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 wage rate on the wage determination which provides for less than full fringe benefits for apprentices. 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.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor 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. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

d. 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.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

6. Subcontracts. The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

7. Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 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 U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility.

a. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

The following clauses apply to any Federal-aid construction contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1.) of this section, the contractor and any subcontractor responsible therefor shall be liable for the 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 or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1.) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1.) of this section.

3. Withholding for unpaid wages and liquidated damages. The FHWA or the contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys 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 (2.) of this section.

4. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

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 contracting agency. 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 635.116).

a. The term "perform work with its own organization" refers to workers employed or leased 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 or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions:

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;

(2) the prime contractor remains responsible for the quality of the work of the leased employees;

(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and

(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

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 or propose 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 VI 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 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 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 contracting agency has assured that each subcontract is

evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

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 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. 3704).

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.3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

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, Form FHWA-1022 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:

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 under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.
2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section X in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost \$25,000 or more – as defined in 2 CFR Parts 180 and 1200.

1. Instructions for Certification – First Tier Participants:

- a. By signing and submitting this proposal, the prospective first tier 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 first tier 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 first tier 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 contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier 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," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first 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 entering into this transaction.

g. The prospective first tier 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 Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.

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 is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective 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.

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency;

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment 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;

(3) 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 (a)(2) of this certification; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

b. Where the prospective 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 Participants:

(Applicable to all subcontracts, purchase orders and other lower tier transactions requiring prior FHWA approval or estimated to cost \$25,000 or more - 2 CFR Parts 180 and 1200)

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," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

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 exceeding the \$25,000 threshold.

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 is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

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 Participants:

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 participating in covered transactions 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.

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is 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 its bid or proposal that the participant 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.

AA

8 PROSECUTION AND PROGRESS

10-19-12

Replace "working days" in the 1st paragraph of section 8-1.02B(1) with:

10-19-12

original working days

Replace "working days" at each occurrence in the 1st paragraph of section 8-1.02C(1) with:

10-19-12

original working days

Delete the 4th paragraph of section 8-1.02C(1).

04-20-12

Replace "Contract" in the 9th paragraph of section 8-1.02C(1) with:

10-19-12

work

Replace the 1st paragraph of section 8-1.02C(3)(a) with:

04-20-12

Submit a description of your proposed schedule software for authorization.

Delete the last paragraph of section 8-1.02C(3)(a).

04-20-12

Replace section 8-1.02C(3)(b) with:

10-19-12

8-1.02C(3)(b) Reserved

Delete the 3rd paragraph of section 8-1.02C(5).

04-20-12

Replace "Contract" in the last paragraph of section 8-1.02C(5) with:

10-19-12

original

Replace "working days" in the 1st paragraph of section 8-1.02D(1) with:

10-19-12

original working days

Replace "8-1.02D(1)" in the 2nd paragraph of section 8-1.02D(1) with:

01-20-12

8-1.02C(1)

Replace "Contract" in the 3rd paragraph of section 8-1.02D(2) with:

work

10-19-12

Replace "Contract" in item 9 in the list in the 4th paragraph of section 8-1.02D(4) with:

work

10-19-12

Replace "Contract completion" in the 4th paragraph of section 8-1.02D(6) with:

work completion

10-19-12

Replace "Contract working days" in the 4th paragraph of section 8-1.02D(6) with:

original working days

10-19-12

Delete items 1.3 and 1.4 in the list in the 1st paragraph of section 8-1.02D(10).

04-20-12

Replace the last paragraph of section 8-1.04B with:

The Department does not adjust time for starting before receiving notice of Contract approval.

10-19-12

Replace the 1st paragraph of section 8-1.05 with:

Contract time starts on the last day specified to start job site activities in section 8-1.04 or on the day you start job site activities, whichever occurs first.

10-19-12

Replace the 2nd paragraph of section 8-1.05 with:

Complete the work within the Contract time.

10-19-12

Delete "unless the Contract is suspended for reasons unrelated to your performance" in the 4th paragraph of section 8-1.05.

10-19-12

Replace the headings and paragraphs in section 8-1.06 with:

The Engineer may suspend work wholly or in part due to conditions unsuitable for work progress. Provide for public safety and a smooth and unobstructed passageway through the work zone during the suspension as specified under sections 7-1.03 and 7-1.04. Providing the passageway is force account work. The Department makes a time adjustment for the suspension due to a critical delay.

10-19-12

The Engineer may suspend work wholly or in part due to your failure to (1) fulfill the Engineer's orders, (2) fulfill a Contract part, or (3) perform weather-dependent work when conditions are favorable so that weather-related unsuitable conditions are avoided or do not occur. The Department may provide for a

Add to the end of section 9-1.04A:

10-19-12

For nonsubcontracted work paid by force account for a contract with a TRO bid item, the markups are those shown in the following table instead of those specified in sections 9-1.04B–D:

Cost	Percent markup
Labor	30
Materials	10
Equipment rental	10

Delete ", Huntington Beach," in the 3rd paragraph of section 9-1.07A.

04-20-12

Replace the formula in section 9-1.07B(2) with:

$$Qh = HMATT \times Xa$$

04-20-12

Replace "weight of dry aggregate" in the definition of the variable Xa in section 9-1.07B(2) with:

total weight of HMA

04-20-12

Replace the formula in section 9-1.07B(3) with:

$$Qrh = RHMATT \times 0.80 \times Xarb$$

04-20-12

Replace "weight of dry aggregate" in the definition of the variable $Xarb$ in section 9-1.07B(3) with:

total weight of rubberized HMA

04-20-12

Replace the heading of section 9-1.07B(4) with:

Hot Mix Asphalt with Modified Asphalt Binder

04-20-12

Add between "in" and "modified" in the introductory clause of section 9-1.07B(4):

HMA with

04-20-12

Replace the formula in section 9-1.07B(4) with:

$$Qmh = MHMATT \times [(100 - Xam) / 100] \times Xmab$$

04-20-12

Replace "weight of dry aggregate" in the definition of the variable $Xmab$ in section 9-1.07B(4) with:

total weight of HMA

04-20-12

Replace the formula in section 9-1.07B(5) with:

04-20-12

$$Qrap = HMATT \times Xaa$$

Replace "weight of dry aggregate" in the definitions of the variables *Xaa* and *Xfa* in section 9-1.07B(5) with:

04-20-12

total weight of HMA

Add after the variable definitions in section 9-1.07B(9):

04-20-12

The quantity of extender oil is included in the quantity of asphalt.

Replace the headings and paragraphs in section 9-1.11 with:

10-19-12

9-1.11A General

Section 9-1.11 applies if a bid item for time-related overhead is included in the Contract. If a bid item for time-related overhead is included, you must exclude the time-related overhead from every other bid item price.

9-1.11B Payment Quantity

The TRO quantity does not include the number of working days to complete plant establishment work.

For a contract with a TRO lump sum quantity on the Bid Item List, the Department pays you based on the following conversions:

1. LS unit of measure is replaced with WDAY
2. Lump sum quantity is replaced with the number of working days bid
3. Lump sum unit price is replaced with the item total divided by the number of working days bid

9-1.11C Payment Inclusions

Payment for the TRO bid item includes payment for time-related field- and home-office overhead for the time required to complete the work.

The field office overhead includes time-related expenses associated with the normal and recurring construction activities not directly attributed to the work, including:

1. Salaries, benefits, and equipment costs of:
 - 1.1. Project managers
 - 1.2. General superintendents
 - 1.3. Field office managers
 - 1.4. Field office staff assigned to the project
2. Rent
3. Utilities
4. Maintenance
5. Security
6. Supplies
7. Office equipment costs for the project's field office

The home-office overhead includes the fixed general and administrative expenses for operating your business, including:

1. General administration

2. Insurance
3. Personnel and subcontract administration
4. Purchasing
5. Accounting
6. Project engineering and estimating

Payment for the TRO bid item does not include payment for:

1. The home-office overhead expenses specifically related to:
 - 1.1. Your other contracts or other businesses
 - 1.2. Equipment coordination
 - 1.3. Material deliveries
 - 1.4. Consultant and legal fees
2. Non-time-related costs and expenses such as mobilization, licenses, permits, and other charges incurred once during the Contract
3. Additional overhead involved in incentive/disincentive provisions to satisfy an internal milestone or multiple calendar requirements
4. Additional overhead involved in performing additional work that is not a controlling activity
5. Overhead costs incurred by your subcontractors of any tier or suppliers

9-1.11D Payment Schedule

For progress payments, the total work completed for the TRO bid item is the number of working days shown for the pay period on the *Weekly Statement of Working Days*.

For progress payments, the Department pays a unit price equal to the lesser of the following amounts:

1. Price per working day as bid or as converted under section 9-1.11B.
2. 20 percent of the total bid divided by the number of original working days

For a contract without plant establishment work, the Department pays you the balance due of the TRO item total as specified in section 9-1.17B.

For a contract with plant establishment work, the Department pays you the balance due of the TRO item total in the 1st progress payment after all non-plant establishment work is completed.

9-1.11E Payment Adjustments

The 3rd paragraph of section 9-1.17C does not apply.

The Department does not adjust the unit price for an increase or decrease in the TRO quantity except as specified in section 9-1.11E.

Section 9-1.17D(2)(b) does not apply except as specified for the audit report below.

If the TRO bid item quantity exceeds 149 percent of the quantity shown on the Bid Item List or as converted under section 9-1.11B, the Engineer may adjust or you may request an adjustment of the unit price for the excess quantity. For the adjustment, submit an audit report within 60 days of the Engineer's request. The report must be prepared as specified for an audit report for an overhead claim in section 9-1.17D(2)(b).

Within 20 days of the Engineer's request, make your financial records available for an audit by the State for the purpose of verifying the actual rate of TRO described in your audit. The actual rate of TRO described is subject to the Engineer's authorization.

The Department pays the authorized actual rate for TRO in excess of 149 percent of the quantity shown on the Bid Item List or as converted under section 9-1.11B.

The Department pays for 1/2 the cost of the report; the Contractor pays for the other 1/2. The cost is determined under section 9-1.05.

Replace the paragraphs of section 9-1.16D with:

07-19-13

9-1.16D(1) General

Section 9-1.16D applies if a bid item for mobilization is shown on the Bid Item List.

Payments for mobilization made under section 9-1.16D are in addition to the partial payments made under Pub Cont Code § 10261.

Section 9-1.16D(2) applies unless the Contract includes a special provision for section 9-1.16D(1) that specifies section 9-1.16D(3) applies.

11-15-13

9-1.16D(2) Mobilization for Projects Except for Those Over Water Requiring Marine Access

07-19-13

The Department makes partial payments for mobilization under Pub Cont Code § 10264(a) except the amount of work completed does not include the amount earned for mobilization. The partial payment amount is reduced by a prorated amount bid in excess of the maximum allowed under Pub Cont Code § 10264(a)(5).

The Department pays the item total for mobilization in excess of the maximum allowed under Pub Cont Code § 10264(a)(5) in the 1st payment after Contract acceptance.

9-1.16D(3) Mobilization for Projects Over Water Requiring Marine Access

The Department makes partial payments for mobilization under Pub Cont Code § 10264(b) except the amount of work completed does not include the amount earned for mobilization. The partial payment amount is reduced by a prorated amount bid in excess of the maximum allowed under Pub Cont Code § 10264(b)(6).

The Department pays the item total for mobilization in excess of the maximum allowed under Pub Cont Code § 10264(b)(6) in the 1st payment after Contract acceptance.

10-19-12

Delete "revised Contract" in item 1 of the 1st paragraph of section 9-1.16E(2).

Replace "2014" in the 1st paragraph of section 9-1.16F with:

2020

10-19-12

Replace the 2nd paragraph of section 9-1.17C with:

10-19-12

Submit either a written acceptance of the proposed final estimate or a claim statement postmarked or hand delivered before the 31st day after receiving the proposed final estimate.

Add between "the" and "final estimate" in the 1st sentence in the 3rd paragraph of section 9-1.17C:

proposed

10-19-12

Replace the 1st sentence in the 6th paragraph of section 9-1.17D(2)(b) with:

07-19-13

The CPA's audit must be performed as an examination-level engagement under the attestation engagements in the *Government Auditing Standards* published by the Comptroller General of the United States.

AA

DIVISION II GENERAL CONSTRUCTION

10 GENERAL

04-19-13

Replace the headings and paragraphs in section 10 with:

04-19-13

10-1 GENERAL

10-1.01 GENERAL

Section 10 includes general specifications for general construction work.

10-1.02 WORK SEQUENCING

Before obliterating any traffic stripes, pavement markings, and pavement markers to be replaced at the same location, reference the stripes, markings, and markers. Include limits and transitions with control points to reestablish the new stripes, markings, and markers.

10-1.03 TIME CONSTRAINTS

Reserved

10-1.04 TRAINING AND MEETINGS

Training and meetings are held at times and locations you and the Engineer agree to.

10-1.05–10-1.10 RESERVED

10-2 SUSTAINABLE DESIGN REQUIREMENTS

10-2.01 GENERAL

10-2.01A General

Reserved

10-2.01B–10-2.01H Reserved

10-2.02 CALGREEN TIER 1

10-2.02A–10-2.02H Reserved

10-2.03 LEED

10-2.03A–10-2.03H Reserved

10-3–10-5 RESERVED

10-6 JOB SITE WATER CONTROL

10-6.01 GENERAL

Section 10-6 includes specifications for controlling water to provide a dry working area at the job site.

10-6.02 WATER-FILLED COFFERDAM

Reserved

10-6.03–10-6.10 RESERVED

10-7–10-20 RESERVED

AA

11 QUALITY CONTROL AND ASSURANCE

07-19-13

Replace section 11-2 with:

11-2 RESERVED

07-19-13

Replace the table in the 3rd paragraph of section 11-3.01A with:

07-19-13

AWS code	Year of adoption
D1.1	2010
D1.3	2008
D1.4	2011
D1.5	2010
D1.6	2007
D1.8	2009

Replace "does" in the definition of "continuous inspection" in section 11-3.01B with:

07-19-13

do

Replace "gross nonconformance" and its definition in section 11-3.01B with:

07-19-13

gross nonconformance: Rejectable indications are present in more than 20 percent of the tested weld length.

Replace the introductory clause in the 1st paragraph of section 11-3.01C with:

07-19-13

Replace clause 6.1.3 of AWS D1.1, the 1st paragraph of clause 7.1.2 of AWS D1.4, and clause 6.1.2 of AWS D1.5 with:

Replace the 3rd paragraph of section 11-3.01C with:

07-19-13

For each inspection, including fit-up, WPS verification, and final weld inspection, the QC Inspector must confirm and document compliance with the specifications, AWS welding codes, and any referenced drawings.

Replace the paragraphs in section 11-3.01D with:

07-19-13

The Engineer has the authority to verify the qualifications or certifications of any welder, QC Inspector, or NDT personnel to specified levels by retests or other means determined by the Engineer. If welding will be performed without gas shielding, then qualification must also include welding without gas shielding.

Replace clause 6.14.6.1 of AWS D1.1, clause 7.8 of AWS D1.4, and clause 6.1.3.4 of AWS D1.5 with:

Personnel performing NDT must be qualified and certified under 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 must comply with 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 must be one of the following:

1. Certified NDT Level II technicians
2. Level III technicians certified to perform the work of Level II technicians

Replace the heading and the 1st through 3rd paragraphs of section 11-3.01E with:

07-19-13

11-3.01E Weld Joint Details

If weld joint details proposed for use in the work are not prequalified under clause 3 of AWS D1.1 or figure 2.4 or 2.5 of AWS D1.5, submit the proposed WPS and the intended weld joint locations.

Upon authorization of the proposed joint detail locations and qualification of the proposed joint details, welders and welding operators using these details must weld an additional qualification test plate using the WPS variables and the weld joint detail to be used in production. The test plate must:

1. Have the maximum thickness to be used in production and a minimum length of 18 inches.
2. Be mechanically and radiographically tested. Mechanical and radiographic testing and acceptance criteria must comply with the applicable AWS codes.

If a nonprequalified weld joint configuration is proposed using a combination of WPSs for work welded under AWS D1.1, you may conduct a single test combining the WPSs to be used in production, if the essential variables, including weld bead placement, of each process are limited to those established in table 4.5 of AWS D1.1.

Replace the 1st paragraph of section 11-3.01F with:

07-19-13

Replace paragraph 3 of clause 6.26.3.2 of AWS D1.5 with:

3. If indications that exhibit these planar characteristics are present at scanning sensitivity, or other evidence exists to suggest the presence of transverse cracks, a more detailed evaluation of the discontinuity by other means must be performed (e.g., alternate UT techniques, RT, grinding, or gouging for visual inspection or MT of the excavated areas.). For welds that have transverse cracks, excavate the full length of the crack plus 2 inches of weld metal on each side adjacent to the crack and reweld.

Replace "section" in the 2nd paragraph of section 11-3.01F with:

07-19-13

clause

Replace the 1st paragraph of section 11-3.02A with:

07-19-13

Except for stud welding, section 11-3.02 applies to (1) work welded under sections 49, 52, 55, and 75-1.03E and (2) work in section 99 that must comply with an AWS welding code.

Replace the 4th through 6th paragraphs of section 11-3.02C(2) with:

07-19-13

Submit an amended welding QC plan or an addendum to the welding QC plan for any changes to:

1. WPSs
2. NDT firms
3. QC personnel or procedures

4. NDT personnel or procedures
5. Systems for tracking and identifying welds
6. Welding personnel

Allow 15 days for the Engineer's review of an amended welding QC plan or an addendum to the welding QC plan.

Submit 7 copies of each authorized QC plan and any authorized addendums. Make 1 copy available at each location where work is performed.

Replace the 1st paragraph of section 11-3.02C(3) with:

07-19-13

Submit a welding report within 7 days following the performance of any welding. The welding report must include:

1. Daily production log for welding for each day that welding is performed
2. Reports of all visual weld inspections and NDT performed, whether specified, additional, or informational
3. Radiographs and radiographic reports, and other required NDT reports
4. Summary of welding and NDT activities that occurred during the reporting period
5. Reports of each application of heat straightening
6. Summarized log listing the rejected lengths of weld by welder, position, process, joint configuration, and piece number
7. Documentation that you have:
 - 7.1. Evaluated all radiographs and radiograph reports and NDT and NDT reports
 - 7.2. Corrected all rejectable deficiencies and that all repaired welds have been reexamined using the required NDT and found acceptable
8. Reports or chart recordings of each application of any stress relieving used
9. Reports and chart recordings for any electroslag welding used

Add between "radiographic" and "envelopes" in the introductory clause in the 3rd paragraph of section 11-3.02C(3):

07-19-13

film

Delete the 3rd sentence in the 5th paragraph of section 11-3.02C(3).

07-19-13

Replace the introductory clause in the 1st paragraph of section 11-3.02D with:

07-19-13

Clauses 6.1.4.1 and 6.1.4.3 of AWS D1.1, the 2nd paragraph of clause 7.1.2 of AWS D1.4, clauses 6.1.3.1 through 6.1.3.3 of AWS D1.5, and clause 7.2.3 of AWS D1.8 are replaced with:

Replace items 1 and 2 in the list in the 2nd paragraph of section 11-3.02D with:

07-19-13

1. Work is welded at a permanent fabrication or manufacturing plant that is certified under the AISC Certification Program for Steel Bridge Fabricators, Intermediate Bridges, and Fracture-Critical Member endorsement if required.
2. Structural steel for building construction work is performed at a permanent fabrication or manufacturing plant that is certified under the AISC Quality Certification Program, Category STD, Standard for Steel Building Structures.

Delete the 3rd paragraph of section 11-3.02D.

Replace the 1st sentence in the 4th paragraph of section 11-3.02D with:

Except for the exempt facilities identified above, an authorized independent third party must witness the qualification tests for welders or welding operators.

Replace the paragraph in section 11-3.02F with:

Welding procedures qualification for work welded under AWS D1.5 must comply with clause 5.12 or 5.12.4 of AWS D1.5 and the following:

1. Unless considered prequalified, qualify fillet welds in each position. Conduct the fillet weld soundness test using the essential variables of the WPS as established by the PQR.
2. For qualifying joints that do not comply with figures 2.4 and 2.5 of AWS D1.5, conduct the test complying with figure 5.3 using the welding parameters that were established for the test conducted complying with figure 5.1.
3. Macroetch tests are required for WPS qualification tests, and acceptance must comply with clause 5.19.3 of AWS D1.5.
4. If a nonstandard weld joint is to be made using a combination of WPSs, you may conduct a test under figure 5.3, combining the qualified or prequalified WPSs to be used in production, if the essential variables, including weld bead placement, of each process are limited to those established in table 5.3 of AWS D1.5.
5. Before preparing mechanical test specimens, inspect the PQR welds by visual and radiographic tests. The backing bar must be 3 inches in width and must remain in place during NDT. Results of the visual and radiographic tests must comply with clause 6.26.2 of AWS D1.5 excluding clause 6.26.2.2. All other requirements for clause 5.17 are applicable.

Add to the list in the 3rd paragraph of section 11-3.02G:

3. Repairs not included in the welding QC plan

Replace the 1st sentence of the 4th paragraph of section 11-3.02G with:

Requests to perform 3rd-time excavations, repairs of cracks, or repairs not included in the welding QC plan must include an engineering evaluation.

AA

12 TEMPORARY TRAFFIC CONTROL

Replace the 1st paragraph of section 12-3.01A(4) with:

Category 2 temporary traffic control devices must be on FHWA's list of acceptable, crashworthy Category 2 hardware for work zones. This list is available on FHWA's Safety Program Web site.

Replace "project" in the 4th paragraph of section 12-3.02C with:

10-19-12

work

Add after "Display" in item 4 in the list in the 2nd paragraph of section 12-3.03B:

04-19-13

or Alternating Diamond

Replace "project" in the 3rd paragraph of section 12-3.07C with:

10-19-12

work

Add to section 12-3:

07-19-13

12-3.18 AUTOMATED WORK ZONE INFORMATION SYSTEM

Reserved

12-3.19–12-3.25 RESERVED

Replace the 7th through 9th paragraphs of section 12-4.02A with:

07-19-13

If pedestrian traffic is allowed to pass through construction areas, provide a temporary pedestrian facility through the construction areas within the highway. Include protective overhead covering as necessary to ensure protection from falling objects and drippings from overhead structures.

At locations where pedestrian openings through falsework are required, provide a temporary pedestrian facility with protective overhead covering during all bridge construction activities.

Temporary pedestrian facilities must comply with section 12-7.

If an activity requires a closure of a walkway, another walkway must be made available nearby, off of the traveled way.

Delete the 12th paragraph of section 12-4.02A.

07-19-13

Replace section 12-4.03 with:

07-19-13

12-4.03 CLOSURE SCHEDULES AND CONDITIONS

12-4.03A General

Submit closure schedule requests and closure schedule amendments using LCS to show the locations and times of the requested closures.

The Department provides LCS training. Request the LCS training at least 30 days before submitting the 1st lane closure request. The Department provides the training within 15 days after your request. The training may be web based.

Except for web-based training, the training is held at a time and location you and the Engineer agree to.

For web-based training, the Engineer provides you the website address to access the training.

Within 5 business days after completion of the training, the Department provides LCS accounts and user identifications to your assigned, trained representatives.

Each representative must maintain a unique password and current user information in the LCS.

12-4.03B Closure Schedules

Every Monday by noon, submit a closure schedule request of planned closures for the next week period. The next week period is defined as Sunday noon through the following Sunday noon.

Submit a closure schedule request not less than 25 days and not more than 125 days before the anticipated start of any activity that reduces:

1. Horizontal clearances of traveled ways, including shoulders, to 2 lanes or less due to activities such as temporary barrier placement and paving
2. Vertical clearances of traveled way, including shoulders, due to activities such as pavement overlays, overhead sign installation, falsework, or girder erection

Submit closure schedule amendments, including adding additional closures, by noon at least 3 business days before a planned closure.

Cancel closure requests using LCS at least 48 hours before the start time of the closure.

You will be notified through LCS of unauthorized closures or closures that require coordination with other parties as a condition for authorization.

The Engineer may reschedule a closure cancelled due to unsuitable weather.

If a closure is not opened to traffic by the specified time, suspend work. No further closures are allowed until the Engineer has reviewed and authorized a work plan submitted by you that ensures that future closures will be opened to traffic by the specified time. Allow 2 business days for review of your proposed work plan. The Department does not compensate you for your losses due to the suspension of work resulting from the late opening of closures.

Notify the Engineer of delays in your activities caused by:

1. Your closure schedule request being denied although your requested closures are within the specified time frame allowed for closures. The Department does not compensate you for your losses due to amendments to the closure schedule that are not authorized.
2. Your authorized closure being denied.

If you are directed to remove a closure before the time designated in the authorized closure schedule, you will be compensated for the delay.

12-4.03C Contingency Plan

Section 12-4.03C applies if a contingency plan is specified in the special provisions or if a contingency plan is requested.

If a contingency plan is requested, submit the contingency plan within 1 business day of the request.

The contingency plan must identify the activities, equipment, processes, and materials that may cause a delay in the opening of a closure to traffic. The plan must include:

1. List of additional or alternate equipment, materials, or workers necessary to ensure continuing activities and on-time opening of closures if a problem occurs. If the additional or alternate equipment, materials, or workers are not on site, specify their location, the method for mobilizing these items, and the required time to complete mobilization.
2. General time-scaled logic diagram displaying the major activities and sequence of planned operations. For each activity, identify the critical event when the contingency plan will be activated.

Based on the Engineer's review, additional materials, equipment, workers, or time to complete activities from that specified in the contingency plan may be required.

Submit revisions to a contingency plan at least 3 business days before starting the activity requiring a contingency plan. Allow 2 business days for review of the revised contingency plan.

Replace section 12-7 with:

07-19-13

12-7 TEMPORARY PEDESTRIAN FACILITIES

12-7.01 GENERAL

Section 12-7 includes specifications for constructing temporary pedestrian facilities.

Temporary pedestrian facilities must comply with the *California MUTCD*, Part 6, Chapter 6D, "Pedestrian and Worker Safety."

Design temporary pedestrian facilities with protective overhead covering to support all imposed loads.

The design load and maximum allowable stresses for temporary pedestrian facilities with protective overhead covering must comply with section 48-2.01D(3). The minimum design live load for the temporary pedestrian facilities with protective overhead covering must be 150 psf for the entire structure.

The minimum width of the temporary pedestrian facilities with protective overhead covering between the inside face of handrails must be 60 inches. The clear height of the temporary pedestrian facilities with protective overhead covering measured from the floor surface to the canopy overhead must be at least 8 feet. Provide adequate lighting at all times. Lighting must comply with section 86-6.13.

Submit shop drawings with supporting calculations for temporary pedestrian facilities with protective overhead covering. Shop drawings and calculations must be signed by an engineer who is registered as a civil engineer in the State.

12-7.02 MATERIALS

Walkways must be surfaced with HMA, portland cement concrete, or wood. The surface must be skid resistant and free of irregularities.

Hand railings must be S4S lumber and painted white.

Protective overhead covering of temporary pedestrian facilities must be plywood at least 3/4 inch thick or wood planking with a nominal thickness of 2 inches minimum.

12-7.03 CONSTRUCTION

Construct hand railings on each side of a temporary pedestrian facility as necessary to protect pedestrian traffic from hazards due to work activities or adjacent vehicular traffic.

Maintain temporary pedestrian facilities in good condition and keep them clear of obstructions.

12-7.04 PAYMENT

Not Used

AA

13 WATER POLLUTION CONTROL

11-15-13

04-19-13

Delete item 3 in the list in the 4th paragraph of section 13-1.01A.

Add to section 13-1.01A:

11-15-13

Comply with the Department's general permit issued by the State Water Resources Control Board for *Order No. 2012-0011-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)*. The Department's general permit governs stormwater and nonstormwater discharges from the Department's properties, facilities, and activities. The Department's general permit may be viewed at the Web site for the State Water Resources Control Board, Storm Water Program, Caltrans General Permit.

Add to the list in the 1st paragraph of section 13-1.01D(3)(b):

10-21-11

3. Have completed SWRCB approved QSD training and passed the QSD exam

Add to the list in the 2nd paragraph of section 13-1.01D(3)(b):

10-21-11

3. Have completed SWRCB approved QSP training and passed the QSP exam

Replace "NEL violation" in item 3.6.2 in the list in the 1st paragraph of section 13-1.01D(3)(c) with:

04-19-13

receiving water monitoring trigger

Replace the 1st paragraph in section 13-2.01B with:

04-19-13

Within 7 days after Contract approval, submit 2 copies of your WPCP for review. Allow 5 business days for review.

After the Engineer authorizes the WPCP, submit an electronic copy and 3 printed copies of the authorized WPCP.

If the RWQCB requires review of the authorized WPCP, the Engineer submits the authorized WPCP to the RWQCB for its review and comment. If the Engineer orders changes to the WPCP based on the RWQCB's comments, amend the WPCP within 3 business days.

Replace the 1st paragraph in section 13-3.01B(2)(a) with:

04-19-13

Within 15 days of Contract approval, submit 3 copies of your SWPPP for review. The Engineer provides comments and specifies the date when the review stopped if revisions are required. Change and resubmit a revised SWPPP within 15 days of receiving the Engineer's comments. The Department's review resumes when a complete SWPPP has been resubmitted.

When the Engineer authorizes the SWPPP, submit an electronic copy and 4 printed copies of the authorized SWPPP.

If the RWQCB requires review of the authorized SWPPP, the Engineer submits the authorized SWPPP to the RWQCB for its review and comment. If the Engineer requests changes to the SWPPP based on the RWQCB's comments, amend the SWPPP within 10 days.

Replace "NELs" in item 3.1 in the 3rd paragraph of section 13-3.01B(2)(a) with:

04-19-13

receiving water monitoring triggers

Replace section 13-3.01B(6)(c) with:

04-19-13

13-3.01B(6)(c) Receiving Water Monitoring Trigger Report

Whenever a receiving water monitoring trigger is exceeded, notify the Engineer and submit a receiving water monitoring trigger report within 48 hours after conclusion of a storm event. The report must include:

1. Field sampling results and inspections, including:
 - 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 from the storm event
2. Description of BMPs and corrective actions

Replace "NEL" in the 6th paragraph of section 13-3.01C(1) with:

04-19-13

receiving water monitoring trigger

Replace section 13-3.01C(3) with:

04-19-13

13-3.01C(3) Receiving Water Monitoring Trigger

For a risk level 3 project, receiving water monitoring triggers must comply with the values shown in the following table:

Receiving Water Monitoring Trigger

Parameter	Test method	Detection limit (min)	Unit	Value
pH	Field test with calibrated portable instrument	0.2	pH	Lower limit = 6.0 Upper limit = 9.0
Turbidity	Field test with calibrated portable instrument	1	NTU	500 NTU max

The storm event daily average for storms up to the 5-year, 24-hour storm must not exceed the receiving water monitoring trigger for turbidity.

The daily average sampling results must not exceed the receiving water monitoring trigger for pH.

04-19-13

Delete "and NELs are violated" in the 3rd paragraph of section 13-3.03C.

Replace "working days" at each occurrence in section 13-3.04 with.

10-19-12

original working days

Delete the 1st sentence in the 2nd paragraph of section 13-4.03C(3).

04-19-13

Add between the 2nd and 3rd paragraphs of section 13-4.03C(3):

04-19-13

Manage stockpiles by implementing water pollution control practices on:

1. Active stockpiles before a forecasted storm event
2. Inactive stockpiles according to the WPCP or SWPPP schedule

Replace the paragraph in section 13-4.04 with:

Not Used

04-20-12

Replace "20-7.02D(6)" in section 13-5.02C with:

20-5.03E

07-19-13

Delete "or stockpile" in the 3rd paragraph of section 13-5.02F.

10-19-12

Replace "20-7.03I(10)" in section 13-5.03C with:

20-5.03E(3)

07-19-13

Replace section 13-5.03F with:

13-5.03F Reserved

04-20-12

Delete "or stockpile" in item 1 in the list in the 1st paragraph of section 13-5.03K.

10-19-12

Delete the 3rd paragraph of section 13-5.03K.

10-19-12

Replace the 2nd sentence in the 1st paragraph of section 13-9.01A with:

You may use any of the following systems for temporary concrete washout:

10-19-12

1. Temporary concrete washout facility
2. Portable temporary concrete washout
3. Temporary concrete washout bin

Replace the 2nd paragraph of section 13-9.01B with:

Retain and submit an informational submittal for records of disposed concrete waste.

10-19-12

15-2.02B(5)(b) Saw Cuts

Saw cut using a diamond blade and make cuts perpendicular to the pavement surface. Saw cutting is not required where concrete pavement is adjacent to asphalt concrete pavement.

Saw cut (1) no more than 2 days before removing pavement and (2) such that traffic will not dislodge any pavement piece or segment. Saw cut perpendicular to the traveled way except you may cut parallel or diagonal to the traveled way when removing the pavement during the same lane closure as the saw cutting.

You may make additional saw cuts within the sawed outline.

Saw cuts must be the full depth of the pavement unless otherwise shown.

Saw cut at longitudinal and transverse joints to remove entire slabs. For partial-slab areas, the Engineer determines the exact saw-cut locations.

15-2.02B(5)(c) Reserved

15-2.02B(6) Reserved

15-2.02B(7) Payment

Reserved

Replace section 15-2.02G with:

07-19-13

15-2.02G Remove Guardrail

Where removing guardrail, remove any concrete anchors and steel foundation tubes.

Replace the 1st paragraph of section 15-2.02K with:

07-19-13

Box culverts, concrete pipes, inlets, headwalls, and endwalls must be completely removed if any portion of these structures is (1) within 3 feet of the grading plane in excavation areas, (2) within 1 foot of original ground in embankment areas, or (3) shown to be removed.

Replace "Metal beam guard railing" in the table in the 2nd paragraph of section 15-2.03A(2)(a) with:

07-19-13

Guardrail

Replace the heading of section 15-2.03B with:

07-19-13

Salvage Guardrail

Replace the heading of section 15-2.04D with:

07-19-13

Reconstruct Guardrail

Replace section 15-2.09D with:

07-19-13

15-2.09D Reserved

Replace the 4th paragraph of section 15-2.10B with:

01-18-13

Instead of using new materials similar in character to those in the existing structure, you may use raising devices to adjust a manhole to grade. Before starting paving work, measure and fabricate raising devices. Raising devices must:

1. Comply with the specifications for section 75 except that galvanizing is not required
2. Have a shape and size that matches the existing frame
3. Be match marked by painting identification numbers on the device and corresponding structure
4. Result in an installation that is equal to or better than the existing one in stability, support, and nonrocking characteristics
5. Be fastened securely to the existing frame without projections above the surface of the road or into the clear opening

Replace the heading of section 15-2.10D with:

07-19-13

Adjust Guardrail

Replace the paragraphs of section 15-3.01 with:

07-19-13

Section 15-3 includes specifications for removing all or a portion of a concrete facility.

Concrete facilities include curbs, gutters, gutter depressions, sidewalks, driveways, slope paving, island paving, barriers, retaining walls, sound walls, minor structures, aprons, spillways, and dams.

Where broken-concrete slope protection is shown, use removed concrete for the construction of the broken-concrete slope protection.

Instead of disposing of removed concrete by removing it from the job site, you may dispose of it on the job site by one of the following methods:

1. Burying it in embankments at authorized locations. Removed concrete must be broken into pieces that can be readily handled and incorporated into embankments and placed at a depth of at least 3 feet below finished grade and slope lines. Concrete must not be buried in areas where piling is to be placed or within 10 feet of trees, pipelines, poles, buildings or other permanent objects or structures.
2. Placing it at authorized locations. The removed concrete must not present an unsightly appearance from the highway.

Replace the paragraph of section 15-3.02 with:

07-19-13

Not Used

Delete the 5th paragraph of section 15-3.03.

07-19-13

Add to the end of section 15-4.01A(2):

04-19-13

Allow 20 days for review of the bridge removal work plan.

Replace the 1st paragraph of section 15-5.01C(1) with:

10-19-12

Before starting deck rehabilitation activities, complete the removal of any traffic stripes, pavement markings, and pavement markers.

Replace the 2nd and 3rd paragraphs of section 15-5.01C(2) with:

10-19-12

Perform the following activities in the order listed:

1. Abrasive blast the deck surface with steel shot. Perform abrasive blasting after the removal of any unsound concrete and placement of any rapid setting concrete patches.
2. Sweep the deck surface.
3. Blow the deck surface clean using high-pressure air.

Replace the 2nd paragraph of section 15-5.01C(4) with:

10-19-12

Before removing asphalt concrete surfacing, verify the depth of the surfacing at the supports and midspans of each structure (1) in each shoulder, (2) in the traveled way, and (3) at the roadway crown, if a crown is present.

Delete "and concrete expansion dams" in the 3rd paragraph of section 15-5.01C(4).

04-19-13

Replace the 2nd paragraph of section 15-5.03A(2) with:

10-19-12

For a contract with less than 60 original working days, submit certificates of compliance for the filler material and bonding agents.

Replace "51-1.02C" in the 1st paragraph of section 15-5.03B with:

04-19-13

51-1.02F

Replace the 4th paragraph of section 15-5.03B with:

10-19-12

For a contract with less than 60 original working days, alternative materials must be authorized before use.

Add between the 5th and 6th paragraphs of section 15-5.03C:

10-19-12

The final surface finish of the patched concrete surface must comply with section 51-1.03F.

Delete the 4th paragraph of section 15-5.05C.

10-19-12

Replace "51-1.03F(5)" in the 3rd paragraph of section 15-5.06C(1) with:

51-1.01D(4)(b)

07-19-13

Replace "51-1.03E(5)" in the 5th paragraph of section 15-5.06C(1) with:

51-1.03F(5)

10-19-12

Delete the 9th paragraph of section 15-5.06C(1).

10-19-12

Delete the 15th paragraph of section 15-5.06C(1).

04-19-13

Add between the 18th and 19th paragraphs of section 15-5.06C(1):

Texture the polyester concrete surface before gelling occurs by longitudinal tining under 51-1.03F(5)(b)(iii), except do not perform initial texturing.

07-19-13

Replace section 15-5.06C(2) with:

15-5.06C(2) Reserved

04-19-13

Delete the 3rd paragraph of section 15-5.06D.

04-19-13

Replace the 1st paragraph in section 15-5.07B(4) with:

Payment for furnishing dowels is not included in the payment for core and pressure grout dowel.

10-19-12

Replace section 15-5.09 with:

15-5.09 POLYESTER CONCRETE EXPANSION DAMS

04-19-13

15-5.09A General

Section 15-5.09 includes specifications for constructing polyester concrete expansion dams.

Polyester concrete expansion dams must comply with the specifications for polyester concrete overlays in section 15-5.06, except a trial slab is not required.

Reinforcement must comply with section 52.

15-5.09B Materials

Not Used

15-5.09C Construction

For new asphalt concrete overlays, place the asphalt concrete overlay before starting polyester concrete activities. Saw cut and remove asphalt concrete at expansion dam locations.

For existing asphalt concrete overlays, remove expansion dams and asphalt concrete to the limits shown. Removing expansion dams must comply with section 15-4 except a bridge removal work plan is not required.

Where a portion of the asphalt concrete overlay is to remain, saw cut a 2-inch-deep neat line along the edge to remain in place before removing the asphalt concrete. Do not damage the existing surfacing to remain in place.

Prepare the deck surface under section 15-5.01C(2).

You may use a mechanical mixer to mix the polyester concrete for expansion dams. The mixer capacity must not exceed 9 cu ft unless authorized. Initiate the resin and thoroughly blend it immediately before mixing it with the aggregate. Mix the polyester concrete for at least 2 minutes before placing.

The application rate of methacrylate resin must be approximately 100 sq ft/gal.

You may place and finish expansion dams using hand methods.

Protect expansion dams from moisture, traffic, and equipment for at least 4 hours after finishing.

For expansion dams over 6 feet long, install 1/4-inch-wide joint material at 6-foot intervals across the width of the expansion dam. Joint material must be either expanded polyurethane or expanded polyethylene.

15-5.09D Payment

Not Used

Add to section 15-6.01A(3)(a):

07-19-13

Within 5 days of completing annular space grouting at a culvert, submit the grouting records.

Replace "41-1.01" in item 10.3 in the list in the 2nd paragraph of section 15-6.01A(3)(d) with:

07-19-13

41-2

Replace "41-1.02" in 1st paragraph of section 15-6.01B(2) with:

07-19-13

41-2

Replace the heading of section 15-6.04 with:

01-18-13

INVERT PAVING

Replace the 1st paragraph of section 15-6.13A(1) with:

07-19-13

Section 15-6.13 includes specifications for installing machine spiral wound PVC pipeliners directly into the culvert.

Replace the heading of section 15-6.13B with:

07-19-13

Machine Spiral Wound PVC Pipeliners, Grouted

For ground anchor walls, a wall zone is the entire wall unless otherwise specified in the special provisions.

Delete the 2nd sentence in the 4th paragraph of section 19-3.01A(3)(b).

01-20-12

Replace "90" in the paragraph of section 19-3.02G with:

90-1

01-18-13

Add to section 19-3.02:

19-3.02I Filter Fabric

Filter fabric must be Class A.

07-19-13

Replace the heading of section 19-3.03C with:

19-3.03B(4) Cofferdams

04-19-13

Replace the heading of section 19-3.03D with:

19-3.03B(5) Water Control and Foundation Treatment

04-19-13

Replace the 1st paragraph of section 19-3.03E(3) with:

Compact structure backfill behind lagging of soldier pile walls by hand tamping, mechanical compaction, or other authorized means.

01-20-12

Add to the end of section 19-3.03E(3):

If filter fabric is shown behind the lagging:

07-19-13

1. Immediately before placing the filter fabric, remove any loose or extraneous material and sharp objects from the surface to receive the filter fabric.
2. Handle and place the filter fabric under the manufacturer's instructions. Stretch, align, and place the fabric without wrinkling.
3. Stitch the adjacent borders of filter fabric or overlap the adjacent borders by 12 to 18 inches. If stitching the border, use yarn of a contrasting color. Yarn size and composition must be as recommended by the fabric manufacturer. Use 5 to 7 stitches per inch of seam.
4. Repair any damaged filter fabric by placing a piece of filter fabric large enough to cover the damaged area and comply with the overlapping or stitching requirements.

Replace the 2nd paragraph of section 19-3.03F with:

Do not backfill over or place material over slurry cement backfill until 4 hours after placement. When concrete sand is used as aggregate and the in-place material is free draining, you may start backfilling as soon as the surface water is gone.

01-20-12

Add between the 2nd and 3rd paragraphs of section 19-3.03K:

01-20-12

Before you excavate for the installation of ground anchors in a wall zone:

1. Complete stability testing
2. Obtain authorization of test data

Replace the 2nd sentence of the 7th paragraph of section 19-3.03K:

01-20-12

Stop construction in unstable areas until remedial measures have been taken. Remedial measures must be submitted and authorized.

Add between the 8th and 9th paragraphs of section 19-3.03K:

01-20-12

When your excavation and installation methods result in a discontinuous wall along any soil nail row, the ends of the structurally completed wall section must extend beyond the ends of the next lower excavation lift by a distance equal to twice the lift height. Maintain temporary slopes at the ends of each wall section to ensure slope stability.

Replace the 9th paragraph of section 19-3.03K:

01-20-12

Do not excavate to the next underlying excavation lift until the following conditions have been attained for the portion of the soil nail or ground anchor wall in the current excavation lift:

1. Soil nails or ground anchors are installed and grouted.
2. Reinforced shotcrete facing is constructed.
3. Grout and shotcrete have cured for at least 72 hours.
4. Specified tests are complete for that portion of wall and the results are authorized.
5. Soil nail facing anchorages are attached or ground anchors are locked off.

01-18-13

01-20-12

Replace the 2nd sentence in the 7th paragraph of section 19-3.04 with:

01-18-13

Structure excavation more than 0.5 foot from the depth shown is paid for as a work-character change if you request an adjustment or the Engineer orders an adjustment.

Replace "Contract completion time" in the 8th paragraph of section 19-6.03D with:

10-19-12

work completion date

Add to section 19:

01-18-13

19-10-19-20 RESERVED

20 LANDSCAPE

11-15-13

Replace the headings and paragraphs in section 20 with:

07-19-13

20-1 GENERAL

20-1.01 GENERAL

20-1.01A Summary

Section 20-1 includes general specifications for performing landscaping.

If an irrigation system is to be installed in an existing planting area to be maintained, check for plant deficiencies under section 20-3.02A(4) before starting irrigation work.

Perform a functional test for each irrigation system under 20-2.01A(4)(d):

1. Before planting the plants
2. After planting the plants
3. Before the start of the plant establishment work

If a plant is to be transplanted or an irrigation component is to be relocated, transplant plant or protect irrigation components before performing other construction activities in the area.

Perform roadside clearing:

1. As required to prepare the job site for construction work
2. Until the start of the plant establishment work or Contract acceptance, whichever comes first

20-1.01B Definitions

Reserved

20-1.01C Submittals

At least 15 days before applying any pesticide, submit a copy of the licensed pest control adviser's recommendation.

At the end of each week, submit a report documenting the application of all pesticides as an informational submittal. Use form *Report of Chemical Spray Operations*.

Before mixing a pesticide, submit a copy of the registered label for the pesticide as an informational submittal. If unable to copy, allow the Engineer to read the label on the container.

20-1.01D Quality Control and Assurance

20-1.01D(1) General

Obtain a recommendation from a licensed pest control adviser for the use of all pesticides under the Food & Agri Code. The recommendation must include the pesticides to be used, rates of application, methods of application, and application areas.

The pesticide applicator must have an active and valid qualified applicator license or certificate from the Department of Pesticide Regulation.

20-1.01D(2) Progress Inspections

The Engineer will perform progress inspections before:

1. Cultivating work starts
2. Pressure testing of irrigation pipe on the supply side of control valves
3. Testing of low voltage conductors
4. Planting work starts
5. Completion of planting work

Notify the Engineer at least 4 business days before each inspection is required. Allow at least 3 business days for the Engineer's inspection.

Unless otherwise authorized, do not proceed with the next construction activity until the inspection has been completed and any required corrective work has been performed and authorized.

20-1.02 MATERIALS

20-1.02A General

Reserved

20-1.02B Water

Water available from an existing Department-owned facility within the project limits or an irrigation system to be installed under the Contract is furnished at no charge.

If water is not available, make arrangements for supplying water. Water must be of a quality that will promote plant growth.

20-1.02C Pesticides

Pesticides must comply with the Department of Pesticide Regulation.

Insecticide must be imidacloprid.

Rodenticides must be brodifacoum, bromadiolone, or diphacinone.

Do not use oil or pelleted forms of pesticides for weed control.

For weed control, use a pesticide with a photosensitive dye that produces a contrasting color when sprayed on the ground. The color must disappear between 2 to 3 days after being applied. The dye must not stain surfaces or injure plants or wildlife when applied at the manufacturer's recommended application rate.

20-1.03 CONSTRUCTION

20-1.03A General

Take precautions to prevent irrigation water from:

1. Wetting vehicles, pedestrians, and pavement
2. Eroding soil

Dispose of removed, pruned, and damaged vegetative material.

You may reduce removed vegetative material to chips with a maximum thickness of 1/2 inch and spread within the job site at locations determined by the Engineer. Chipped material must not be substituted for wood mulch, nor must the chipped material be placed within areas to receive wood mulch.

20-1.03B Pesticides

Notify the Engineer of pesticide application times at least 24 hours before each application.

Mix and apply pesticides under the requirements of the Department of Pesticide Regulation and the instructions on the pesticide product label.

Do not apply pesticides:

1. On Saturdays and holidays unless authorized
2. Whenever weather and wind conditions are unsuitable for application
3. Within the plant basin
4. On the foliage and woody parts of the plant

If a granular preemergent is used, it must be covered with mulch on the same work day. Do not apply granular preemergent in plant basins.

Do not apply preemergents:

1. To groundcover plants before the plants have been planted a minimum of 3 days and have been thoroughly watered
2. Within 18 inches of trees, shrubs, and seeded areas

20-1.03C Roadside Clearing

20-1.03C(1) General

Perform roadside clearing by:

1. Removing and disposing of trash and debris
2. Controlling the following pests:
 - 2.1. Rodents
 - 2.2. Insects
 - 2.3. Weeds
3. Removing existing plants as described

Control rodents by using rodenticides or traps.

20-1.03C(2) Remove Existing Plants

Remove existing plants as described. Removal of existing plants includes removing their stumps and roots 2 inches or larger in diameter to a minimum depth of 12 inches below finished grade. Backfill holes resulting from stump removal to finished grade with material obtained from adjacent areas.

If a plant is to be planted within existing groundcover area, remove existing groundcover from within an area 6 feet in diameter centered at each plant location.

20-1.03C(3) Weed Control

Control weeds by the use of pesticides, hand pulling, or mowing.

If pesticides are used to control weeds, apply pesticides before the weeds reach the seed stage of growth or exceed 4 inches in length, whichever occurs first. Do not use pesticides at cutting plant locations.

Where cuttings are to be planted, control weeds by hand pulling within an area 2 feet in diameter centered at each plant location.

If weeds are to be controlled by hand pulling, hand pull weeds before they reach the seed stage of growth or exceed 4 inches in length, whichever occurs first.

Where liner, plug, or seedling plants are to be planted 10 feet or more apart, control weeds by the use of pesticides or hand pulling within an area 2 feet in diameter centered at each plant location. Where liner, plug, or seedling plants are to be planted less than 10 feet apart, control weeds by the use of pesticides within the entire area.

Control weeds by mowing outside of mulched areas, plant basins, groundcover areas, and within areas to be seeded. Mowing must extend to the edges of pavement, dikes, curbs, sidewalks, walls, and fences.

If mowing is to be performed within areas to be seeded, perform mowing as needed until the start of the seeding operation specified in section 21.

Mowing must be performed before the weeds reach the seed stage of growth or exceed 6 inches in length, whichever occurs first. Mow weeds to a height of 3 inches.

20-1.03C(4) Disposal of Removed Groundcover, Weeds, and Mowed Material

Dispose of hand pulled weeds the same day they are pulled. Dispose of removed groundcover within 3 days.

Dispose of mowed material from the initial mowing. Disposal of material from subsequent mowing is not required.

20-1.03D Cultivation

Cultivation must be by mechanical methods and performed until the soil is in a loose condition to a minimum depth of 6 inches. Soil clods must not be larger than 2 inches in maximum dimension after cultivation.

The areas to be cultivated must extend 12 inches beyond the outer limit of each planting area requiring cultivation.

After initial cultivation, place soil amendment and fertilizer at specified rates.

Recultivate to thoroughly mix native soil and amendments.

Do not drive on cultivated areas after cultivation.

Planting areas that have been cultivated and become compacted must be recultivated.

Rocks and debris encountered during soil preparation in planting areas must be brought to the surface of the ground.

Remove rocks and debris as ordered. This work is change order work.

20-1.03E Weed Germination

Reserved

20-1.04 PAYMENT

Items paid for by area are measured parallel to the ground surface.

Planting areas that do not require cultivation but are within the cultivation areas will not be deducted.

20-2 IRRIGATION

20-2.01 GENERAL

20-2.01A General

20-2.01A(1) Summary

Section 20-2 includes specifications for installing irrigation systems.

The irrigation systems shown are diagrammatic.

20-2.01A(2) Definitions

Reserved

20-2.01A(3) Submittals

20-2.01A(3)(a) General

Submit shop drawings for the electrical components of the irrigation system except electrical service 30 days before installation. The drawings must:

1. Include schematic wiring diagrams showing wire sizes and routes between electrical components
2. Show conduit sizes
3. Bear the written approval of the controller manufacturer or the manufacturer's authorized agent
4. Be accompanied by:
 - 4.1. Colored wire and splice samples
 - 4.2. Manufacturer's descriptive and technical literature

After the work shown on the drawing is complete, submit 3 copies of the as-built shop drawings including any wire modifications for each controller installed.

For each controller, laminate and place in an envelope 1 copy of:

1. As-built schematic wiring diagram including wiring modifications
2. 11 by 17 inches as-built irrigation plan

The laminate must be clear, mat-finished plastic that is at least 10 mils thick. The envelope must be heavy-duty plastic.

Attach the envelope to the inside of the controller enclosure or cabinet door. If the door is not large enough to secure the envelope, submit the envelope and its contents.

20-2.01A(3)(b) Manufacturer's Instructions

Submit as an informational submittal the manufacturer's installation instructions 15 days before installing:

1. Couplings for conduits used for irrigation conduits
2. Plastic pipe and fittings
3. Solvent cement for plastic pipe and flexible hose
4. Sprinklers
5. Flow sensors

20-2.01A(3)(c) Maintenance and Operation Manuals

Before Contract acceptance, submit as an informational submittal a manufacturer's maintenance and operation manual for each type of controller installed.

20-2.01A(4) Quality Control and Assurance

20-2.01A(4)(a) General

Reserved

20-2.01A(4)(b) Pressure Testing

20-2.01A(4)(b)(i) General

Perform pressure testing for leakage on irrigation supply lines:

1. In the Engineer's presence
2. On business days between 8 a.m. and 5 p.m. unless authorized
3. Before backfilling supply line trenches
4. With irrigation system gate valves open
5. With open ends of the supply line and fittings plugged or capped

Notify the Engineer at least 48 hours before performing a pressure test.

Choose either Method A or B to test supply lines installed by trenching and backfilling and supply lines that are completely visible after installation.

All other supply lines, including those installed in the ground by methods other than trenching and backfilling must be tested by Method A.

Test irrigation supply line in conduit by Method A with the testing period modified to 0.5 hour and no allowable pressure drop.

20-2.01A(4)(b)(ii) Method A

Method A pressure testing procedures for leakage must comply with the following:

1. Pressure gauge must be calibrated from 0 to 200 psi in 5 psi increments and be accurate to within a tolerance of 2 psi.
2. Supply line must be filled with water and connected to a pressure gauge. Place the pipeline under a pressure of 125 psi. Remove the source of pressure and leave the line under the required pressure.
3. Test the supply line under the required pressure for a period of 1 hour. The pressure gauge must remain in place until each test period is complete.
4. Leaks that develop in the tested portion of the system must be located and repaired after each test period if a drop of more than 5 psi is indicated by the pressure gauge. After the leaks have been repaired, repeat the 1 hour pressure test until the drop in pressure is 5 psi or less.

If a system consists of a new supply line connected to an existing line, the new supply line must be isolated from the existing line and tested.

20-2.01A(4)(b)(iii) Method B

Method B pressure testing procedures for leakage must comply with the following:

1. Before any portion of the supply line on the upstream side of a control valve is backfilled, water must be turned on for that portion of the line and maintained at full pressure from the water source for a period not less than 8 consecutive hours after all air has been expelled from the line. Before any

portion of the supply line on the downstream side of the control valve is backfilled, perform the same test for a period not less than 1 hour.

2. Repair leaks that develop in the tested portion of the system. After the leaks have been repaired, repeat the pressure test until no leaks occur as determined by the Engineer.

20-2.01A(4)(c) Sprinkler Coverage Check

After installation of the sprinklers, check and adjust the entire sprinkler system for proper orientation and uniform coverage.

20-2.01A(4)(d) Irrigation System Functional Tests

The functional tests for each irrigation controller or group of controllers and associated irrigation system served by a single electric service point must consist of at least 1 complete cycle of operation. The Engineer determines the length of the cycle.

Notify the Engineer at least 10 days before performing each functional test.

20-2.01A(4)(e) Final Irrigation System Check

Perform the final check of the existing and new irrigation system between 20 and 30 days before Contract acceptance. The Engineer determines the length of the cycle.

Remote control valves connected to existing and new irrigation controllers must be checked for automatic operation when the controllers are in automatic mode.

20-2.01B Materials

20-2.01B(1) General

Use minor concrete for replacing removed concrete facilities.

HMA for replacing removed asphalt concrete surfacing and facilities must comply with section 39. You may use minor HMA if authorized.

20-2.01B(2) Garden Valves

Each garden valve must:

1. Be inverted nose type and of brass or bronze construction with female thread inlet
2. Have a replaceable seat washer, rising valve stem within a protective collar, and male thread hose outlet
3. Have a loose key handle

20-2.01B(3) Recycled Water Identification

Irrigation components used for recycled water must be manufactured or painted purple. Recycled water irrigation pipe and tubing must have a permanent label with the wording "CAUTION RECYCLED WATER" every 24 inches in 2 rows spaced approximately 180 degrees apart in the longitudinal direction of the pipe or tubing.

The recycled water warning sign must be a decal or a decal attached to a 1/16-inch thick aluminum plate or tag.

Each warning sign decal must:

1. Show the phrase "Recycled Water, Do Not Drink" and the drinking glass graphic symbol
2. Be UV fade and weather resistant and manufactured from flexible vinyl with or without mylar
3. Have a purple background, black text, and self-adhesive backing

Each warning tag must:

1. Show the phrase "RECYCLED WATER" and the drinking glass graphic symbol
2. Be UV fade and weather resistant
3. Be purple, double-sided, and manufactured from polyurethane
4. Have an integral neck attachment and attachment hole capable of withstanding 178 lb of pull-out resistance
5. Have hot-stamped black lettering

Posts and hardware for warning signs must comply with section 56-4.

Concrete sprinkler protectors used with recycled water must be painted purple.

20-2.01B(4) Location Markers

Location markers must be schedule 40 white PVC plastic pipe.

20-2.01B(5) Pull Boxes

Pull boxes must comply with section 86-2.06 and be no. 5 or larger unless otherwise shown. Pull boxes for low voltage conductors must not have side openings.

Pull box covers used solely for irrigation electrical service must be marked "IRRIGATION".

20-2.01B(6) Unions

Unions must be brass or malleable iron capable of withstanding the maximum required working pressure.

20-2.01B(7) Valve Boxes and Covers

Valve boxes must be precast concrete.

Covers must be:

1. Concrete, steel, or cast iron.
2. Marked "WATER" in cast-in letters not less than 1 inch high.
3. 1 piece, except 2 pieces are required when the weight of the valve box cover exceeds 35 lb.

The valve box covers must include a polyurethane label with the appropriate controller letter and station number as shown.

20-2.01B(8) Wye Strainers

Wye strainers must:

1. Have a cast iron or all bronze body
2. Have a removable stainless steel strainer screen:
 - 2.1. With an open area equal to at least 3 times the cross-sectional area of the pipe based on an iron pipe size
 - 2.2. With 40-mesh woven wire, except:
 - 2.2.1. For a backflow preventer assembly, the screen must be 20-mesh woven wire mesh or perforated sheet with 0.045-inch diameter holes
 - 2.2.2. For a valve assembly, the screen must be 80-mesh woven wire mesh
3. Be capable of withstanding a working pressure of 150 psi
4. Be equipped with a garden valve at the outlet

The wye strainer filter housing must:

1. Withstand a working pressure of 150 psi
2. Be manufactured of reinforced polypropylene plastic

20-2.01C Construction

20-2.01C(1) General

Repair irrigation systems within 24 hours after a malfunction or damage occurs.

Connect underground metallic pipes, valves, or fittings made of dissimilar metals through a dielectric coupling or bushing.

You may install conduits, conductors, and supply lines by methods other than trenching provided that they are not damaged and are installed at the depths specified.

20-2.01C(2) Trenching and Backfilling

Trench and backfill under section 86-2.01.

Remove plants under 20-1.03C as necessary to perform trenching. If plants are to remain, adjust trench alignment to minimize damage.

If removal of:

1. Turf is required, remove to a maximum width of 12 inches.
2. Groundcover is required, remove to a maximum width of 6 feet. Existing *Carpobrotus* and *Delosperma* may be rototilled if the backfill for the trenches does not contain plants longer than 6 inches in length.

Make a 2-inch deep sawcut along neat lines around the perimeter of the pavement to be removed at locations determined by the Engineer.

The trench must have uniform bearing throughout the entire length and must be free of jagged rubble or sharp objects. Ensure conduit, supply line, and joints are not moved or damaged by backfill operations.

For a project with multiple water service points, excavate and backfill trenches for 1 service point at a time.

11-15-13

Trenches for irrigation supply lines and conduits 3 inches and larger must be 5 times the pipe or conduit diameter deep and 2 times the pipe or conduit diameter wide.

Trenches for irrigation supply lines and conduits 2-1/2 inches or less in diameter must be a minimum of 12 inches below finished grade, measured from the top of the installed pipe.

07-19-13

Trenches must be at least 4 feet from curbs, dikes, and paved shoulders.

Rocks and debris encountered during trenching operations must be brought to the surface of the ground. Remove rocks and debris as ordered. This work is change order work.

If trenching requires the removal of plants, in areas with:

1. Turf, replace turf with sod under section 20-3.03C(3)(e).
2. Groundcover, replace groundcover plants from flats and plant at 12 inches on center under section 20-3.03C. No replacement of *Carpobrotus* and *Delosperma* is required if removed by rototilling.

11-15-13

Where existing surfacing is removed, replace the structural section to match the materials removed. Replacement concrete must be of uniform smoothness, color, and texture equal to the adjacent concrete surface. Dispose of removed material. Install supply line and conduits at the bottom of trenches and backfill with sand to a depth of 2 inches over the top of the supply lines and conduits. Excluding the part of the trench backfilled with surfacing or pavement, the remainder of the trench must be backfilled with material that is excavated from the trench. Rock, broken concrete, asphalt concrete and other particles larger than 2 inches in greatest dimension must not be used.

07-19-13

20-2.01C(3) Pull Boxes

Install pull boxes under section 86-2.06 at the following locations:

1. At all conductor splices except splices made in valve boxes
2. Within 5 feet of irrigation controllers
3. At ends of electrical conduits
4. At other locations shown

20-2.01C(4) Valve Boxes and Covers

Install and identify each valve box as shown.

In walkways and paved areas, install the top of the valve box flush with the surrounding finished grade.

20-2.01C(5) Recycled Water Warning Signs

Install recycled water warning signs on irrigation facilities using recycled water.

Install sign decals directly to clean, smooth surfaces. Clean the surface with alcohol or an equivalent cleaner before applying the decal.

Install a 4 by 4 inch warning sign decal to each:

1. Backflow preventer assembly
2. Irrigation controller enclosure cabinet door

Install a 2 by 2 inch warning tag to the each remote control valve and valve box cover.

Install a 2-1/2 by 3 inches sign decal to each sprinkler riser.

Under local regulations, install a 12 by 12 inch warning sign decal on an aluminum plate and attach to gates, fences, and walls located in the vicinity of a recycled water irrigation system. On gates and fences, install signs with S hooks and C clips or 14-gauge galvanized steel wire. On concrete walls or other rough surfaces, install signs with a silicon-based adhesive.

20-2.01C(6) Garden Valves

Furnish 3 keys for each garden valve before Contract acceptance.

20-2.01D Payment

Not Used

20-2.02 EXISTING IRRIGATION FACILITIES

20-2.02A General

20-2.02A(1) Summary

Section 20-2.02 includes specifications for checking, testing, operating, replacing, and relocating existing irrigation facilities.

20-2.02A(2) Definitions

Reserved

20-2.02A(3) Submittals

Submit a list of irrigation system deficiencies within 7 days after checking the existing facilities.

20-2.02A(4) Quality Control and Assurance

After irrigation facilities have been relocated, demonstrate in the presence of the Engineer that the relocated facilities function properly.

Certify each existing backflow preventer under section 20-2.03A(4).

20-2.02B Materials

Valve box covers must be the same size as the covers they replace.

Control and neutral conductors must be the same size and color as the control and neutral conductors they replace.

20-2.02C Construction

20-2.02C(1) General

Notify the Engineer at least 4 business days before shutting off the water supply to any portion of the existing irrigation system and immediately after restoring the water supply to any portion of the existing irrigation system.

If an irrigation facility to be relocated is determined unsuitable by the Engineer, replace irrigation facility under section 20-2. This work is change order work.

20-2.02C(2) Check and Test Existing Irrigation Facilities

Before performing irrigation system work, check existing irrigation facilities to remain in place or to be relocated. The Engineer determines the test watering cycle lengths. Check for deficiencies including missing parts, damaged components, and improper operation. Correct deficiencies as ordered. The correction of deficiencies is change order work.

20-2.02C(3) Operate Existing Irrigation Facilities

If the Contract includes a bid item for operate existing irrigation facilities, after performing work under section 20-2.02C(2), operate existing irrigation facilities through Contract acceptance.

Operate existing irrigation facilities except for water meters, underground supply lines, control and neutral conductors, and electrical conduits.

Check for proper operation at least once every 30 days. Adjust, repair, or replace existing irrigation facilities within 7 days of finding any deficiency.

Operate irrigation systems using the automatic irrigation controller until Contract acceptance. You may operate irrigation controllers manually during plant replacement, fertilization, weed germination, and repair work.

Program the irrigation controllers for seasonal requirements.

20-2.02C(4) Replace Valve Box Covers

Existing valve box covers shown to be replaced must remain in place until the new covers are ready to be installed.

Dispose of removed valve box covers.

20-2.02C(5) Relocate Backflow Preventer Assemblies

Relocate backflow preventer assembly as shown and install under section 20-2.03C.

20-2.02C(6) Relocate Water Meters

Relocate water meter as shown.

20-2.02C(7) Relocate Irrigation Controllers

Relocate irrigation controller as shown and install under section 20-2.07C.

20-2.02D Payment

Not Used

20-2.03 BACKFLOW PREVENTER ASSEMBLIES

20-2.03A General

20-2.03A(1) Summary

Section 20-2.03 includes specifications for installing a backflow preventer assembly.

20-2.03A(2) Definitions

Reserved

20-2.03A(3) Submittals

Reserved

20-2.03A(4) Quality Control and Assurance

Each backflow preventer assembly must be certified by a backflow preventer tester. The tester must have an active and valid certification from the water purveyor having jurisdiction.

If the local water purveyor does not have a certification program, the tester must be certified by AWWA or a nearby county with a certification program.

Notify the Engineer at least 5 business days before certifying backflow preventer assembly.

Certify each backflow preventer assembly annually and within 10 days before Contract acceptance.

20-2.03B Materials

20-2.03B(1) General

Each backflow preventer assembly must include:

1. Backflow preventer including gate valve, wye strainer, brass or malleable iron unions, fittings, and supports
2. Blanket
3. Enclosure
4. Concrete pad

Concrete for the pad must be minor concrete, except the concrete must not contain less than 463 pounds of cementitious material per cubic yard. Hand mixing of the concrete is allowed.

20-2.03B(2) Backflow Preventers

Each backflow preventer must:

1. Be reduced-pressure principle type.
2. Comply with the requirements of the water purveyor that has jurisdiction.
3. Be factory-assembled with:
 - 3.1. 2 check valves
 - 3.2. 1 pressure differential relief valve
 - 3.3. 4 test cocks
 - 3.4. 2 shut-off valves manufactured from iron or bronze. Shut-off valves must be one of the following:
 - 3.4.1. Resilient wedge gate valves
 - 3.4.2. Resilient seated and fully ported ball valves
 - 3.4.3. Resilient seated butterfly valves

Backflow preventer components must be capable of withstanding a working pressure of 150 psi.

20-2.03B(3) Backflow Preventer Blankets

Each backflow preventer blanket must:

1. Be polyester fabric coated with vinyl or polymeric resin
2. Be resistant to UV light, water, mildew, and fire
3. Have an R-value from R-30 to R-38

Blankets must have a securing mechanism that includes either zippers, hook-pile tape, grommets, snaps, buttons, or any combination of these. Wherever the backflow preventer is not in an enclosure, the securing mechanism must be capable of accepting a padlock.

20-2.03B(4) Backflow Preventer Enclosures

Each backflow preventer enclosure must:

1. Have expanded metal sides, ends, and top panels fabricated from 9-gauge minimum thickness stainless sheet steel with openings of approximately 3/4 by 1-3/4 inches
2. Have expanded metal panels attached to the 3/16-inch thick steel frame by a series of welds not less than 1/4 inch in length and spaced not more than 4 inches on center, along the edges of the enclosure
3. Have Type 304 stainless steel lock guards with a minimum thickness of 12 gauge.
4. Have hexagonal nuts and lock-type washers
5. Be powder coated by the manufacturer to match color no. 20450 of FED-STD-595.
6. Have padlock clasp or latch and lock mechanism

20-2.03C Construction

Finish exposed top surfaces of concrete pad with a medium broom finish applied parallel to the long dimension of pads.

Install hold-downs for the backflow preventer assembly enclosure when concrete is still plastic.

20-2.03D Payment

Not Used

20-2.04 CAM COUPLER ASSEMBLIES

20-2.04A General

Section 20-2.04 includes specifications for installing a cam coupler assembly.

20-2.04B Materials

Each cam coupler assembly must consist of a cam coupler, dust cap, check valve, pipes, fittings, concrete thrust block, and valve box with woven wire cloth and gravel.

Cam couplers and keys must be manufactured of brass or bronze and be able to withstand a working pressure of 150 psi.

Furnish 3 loose cam coupler keys before Contract acceptance.

20-2.04C Construction

Install cam coupler assemblies in valve boxes as shown.

20-2.04D Payment

Not Used

20-2.05 CONTROL AND NEUTRAL CONDUCTORS

20-2.05A General

20-2.05A(1) Summary

Section 20-2.05 includes specifications for installing control and neutral conductors.

20-2.05A(2) Definitions

Reserved

20-2.05A(3) Submittals

Reserved

20-2.05A(4) Quality Control and Assurance

Perform field tests on control and neutral conductors. Field tests must comply with the specifications for lighting circuits in section 86-2.14B.

Where the conductors are installed by trenching and backfilling, perform field tests after a minimum of 6 inches of backfill material has been placed and compacted over the conductors.

20-2.05B Materials

Control and neutral conductors must comply with the requirements in section 86-2.08.

For connections between 24-volt irrigation controllers and valve solenoids, use control and neutral conductors. Conductors must include a control conductor for each valve and a common neutral.

Conductor insulation color, except for the stripes, must be continuous throughout. The color of the conductors must be consistent from the controller to each valve. Neutral conductors must be white. Do not use white for control conductors. Do not use conductors with green insulation except as permitted by the NEC.

Conductors must be:

1. No. 12 AWG or larger or no. 14 AWG or larger for armor-clad
2. Rated for 36 V or 600 V for armor-clad
3. Rated for direct burial
4. Underground feeder cable Type UF and TWU
5. Solid, uncoated copper for armor-clad
6. Not less than 90 percent of the AWG diameter required

No. 10 and smaller conductors must be insulated with a minimum of 56 mils of PVC or a minimum of 41 mils of polyethylene. No. 8 and larger conductors must be insulated with a minimum of 70 mils of PVC.

No. 10 and smaller armor-clad conductors must be insulated with a minimum of 41 mils of polyethylene. No. 8 and larger armor-clad conductors must be insulated with 54 to 60 mils of PVC.

Armor-clad conductors must include:

1. Stainless steel tape armor, Type 304 and helically wrapped with a 33 percent minimum overlap. The tape must be 0.5 inch wide and at least 0.005 inch thick.
2. PVC outer conductor jacket that is UV resistant and complies with the ICEA S-61-402, NEMA standard WC5 and UL listing 1263. The jacket nominal thickness must be 24 to 30 mils thick.

20-2.05C Construction

20-2.05C(1) General

Reserved

20-2.05C(2) In Open Trenches

Do not install control and neutral conductors above each other in an open trench. Wrap conductors together with electrical tape at 5 foot intervals.

Where conductors are installed in the same trench as supply line, install at the same depth as the line. At other locations, install conductors not less than 12 inches below finished grade.

Where conductors are not in a supply line trench, install conductors at least 4 feet from curbs, dikes, and paved shoulders.

20-2.05C(3) In Conduits

Install conductors in electrical conduit if conductors are to be:

1. Surface mounted
2. Installed in or on structures
3. Installed under paved areas
4. Installed in irrigation conduits
5. Placed in concrete

20-2.05C(4) Splicing

Splice low voltage control and neutral conductors under sections 86-2.09C, 86-2.09D, and 86-2.09E, except do not use method B. Tape used for splice insulation must be PVC tape.

Leave at least 2 feet of slack for each conductor at each:

1. Pull box
2. Valve box for each conductor that is connected to other facilities within the box or spliced within the box

Do not splice conductors in irrigation controller cabinets.

Permanent splice connections must be made with freshly cut and skinned conductors. Do not use temporary splices made for testing valve circuits as permanent splices.

20-2.05C(5) Marking

Mark control and neutral conductors in pull boxes, valve boxes, at irrigation control terminals, and at splices.

Mark conductor terminations and splices with adhesive cloth wrap-around markers. Seal markers with clear, heat-shrinkable sleeves.

Mark nonspliced conductors with clip-on C-shaped white extruded PVC sleeves. Sleeves must have black indented legends of uniform depth with transparent overlays over the legends and chevron cuts for the alignment of 2 or more sleeves.

Identify markers for the control conductors with the appropriate irrigation controller and station number.

20-2.05D Payment

Not Used

20-2.06 FLOW SENSORS

20-2.06A General

Section 20-2.06 includes specifications for installing a flow sensor.

20-2.06B Materials

Each flow sensor must be an inline type with a nonmagnetic spinning impeller as the only moving part.

The electronics housing must:

1. Be schedule 80 PVC or cast 85-5-5-5 bronze
2. Include glass-filled polyphenylene sulfide
3. Be easily removable from the meter body and include 2 ethylene-propylene O-rings

The impeller must be tungsten carbide.

The electronics must be rated to withstand prolonged water immersion conditions and include 2 single conductor 18 AWG leads, 48 inches long.

The insulation must be direct burial UF type colored red for the positive lead and black for the negative lead.

The flow sensor must be capable of withstanding:

1. 100 to 400 psi operating pressure depending on sensor size shown
2. Liquid temperatures up to 220 degrees F
3. Flows from 1/2 to 15 ft/sec

20-2.06C Construction

Install flow sensor as shown.

20-2.06D Payment

Not Used

20-2.07 IRRIGATION CONTROLLERS

20-2.07A General

20-2.07A(1) Summary

Section 20-2.07 includes specifications for installing irrigation controllers.

20-2.07A(2) Definitions

irrigation controller: "Smart" irrigation controller as defined by the Irrigation Association.

remote irrigation control system (RICS): Centralized water management system that consists of a base station, centralized server, satellite controllers.

base station: Designated computer located at a Department maintenance facility or District Office that collects data from a series of satellite controllers through a centralized server.

centralized server: Designated server or web-based application that collects data from all base stations.

web-based application: Encrypted managing software that is coded in a browser-supported language and is executable via a common internet web browser (e.g., Microsoft Internet Explorer, Firefox, Safari, etc.).

satellite controller: Irrigation controller that communicates directly to a base station or centralized server.

network communication: Identified means through which satellite controllers, base stations, and a centralized server communicate to one another (i.e., fiber optics, spread spectrum, phone line, etc.).

remote access device: Device (i.e., FCC compliant radio remote, cell phone or wireless, etc.) used to communicate with satellite controllers from a remote location.

20-2.07A(3) Submittals

Submit as an informational submittal, a complete manufacturer's maintenance and operations manual for each type of controller installed. Submit the manual at the time the wiring plans and diagrams are placed inside the controller enclosure or cabinet door.

20-2.07A(4) Quality Control and Assurance

Provide training by a qualified person on the use and adjustment of the irrigation controllers installed 30 days before Contract acceptance.

Modifications to electrical components must be done by the manufacturer before shipment to the job site.

The installation date and expiration date of the manufacturer's guarantee for the controllers must be permanently marked on the inside face of the controller.

20-2.07B Materials

20-2.07B(1) General

Conventional A/C powered irrigation controllers must operate on 110/120 V, 60 Hz(ac) and supply 24 to 30 VAC, 60 Hz(ac) for operating electrical remote control valves.

Concrete for the pad and foundation must be minor concrete, except the concrete must not contain less than 463 pounds of cementitious material per cubic yard. Hand mixing of the concrete is allowed.

20-2.07B(2) Irrigation Controllers

20-2.07B(2)(a) General

The irrigation controllers must:

1. Be A/C, battery, solar, or 2-wire as shown
2. Be from a single manufacturer.
3. Be fully automatic and capable of operating a complete 30-day or longer irrigation program.
4. Have a switch or button on the face of the irrigation control panel showing that the irrigation controller can be turned on or off and provide for automatic or manual operation. Manual operation must allow cycle start at the desired station and allow for the minimum activation of a single station or have the option to operate multiple stations in sequential or simultaneous operation modes.
5. Have non-volatile memory.
6. Have a watering time display on the face of the control panel.
7. Have a panel and circuit board connected to the low voltage control and neutral conductors by means of a plug and receptacle connectors located within the cabinet enclosure.
8. Have a variable or incremental timing adjustment ranging from 1 minute to 360 minutes per station.
9. Be capable of operating at least 3 program schedules.
10. Be capable of having at least 4 start times per program schedule.
11. Have an output that can energize a pump start circuit or a remote control master valve.
12. Be protected by fuses and circuit breakers.
13. Display a program and station affected by a sensory alert without altering other watering schedules not affected by the alert.
14. Be capable of global manual and automatic seasonal adjustments to all valves in any given program.
15. Automatically alter watering schedule in accordance with evapotranspiration data provided by a local weather station or have an internal programmed default of historical evapotranspirational data for a given region.
16. Support a flow sensor, rain sensor, or weather station and have automatic shut-off capability.
17. Be capable of communicating with the remote access device.

If the irrigation controller is installed in an enclosure cabinet, the cabinet must be stainless steel and must comply with section 86-3.04A.

Irrigation controllers not installed in enclosure cabinets must be weatherproof, constructed of fiberglass or metal and have a door lock with 2 keys provided.

RICS must meet the requirements of an irrigation controller and be capable of being accessible only through a secured and encrypted server that is password and firewall protected by the Department or be accessible through a firewall secure remote server that is independent from any Department servers. The Department will set up and manage the network communication.

20-2.07B(2)(b) Battery Powered Irrigation Controllers

Reserved

20-2.07B(2)(c) Solar Powered Irrigation Controllers

Reserved

20-2.07B(2)(d) Two-wire Irrigation Controllers

Reserved

20-2.07B(3) Irrigation Controller Enclosure Cabinets

The irrigation controller enclosure cabinet must:

1. Be stainless steel.
2. Include a mounting panel. Fabricate mounting panels with one of the following:
 - 2.1. 3/4-inch exterior AC grade veneer plywood. Paint panels with 1 application of an exterior, latex based, wood primer and 2 applications of an exterior, vinyl acrylic enamel, white in color. Paint panels on all sides and edges before installation of the panels in the cabinets and the equipment on the panels.
 - 2.2. 3/16-inch thick aluminum sheets.
 - 2.3. 10-gauge cold-rolled steel sheets.
 - 2.4. 0.157-inch stainless steel metal sheets.
3. Provide cross ventilation, roof ventilation, or a combination of both. Ventilation must not compromise the weather resistance properties of the cabinet and must be fabricated by the cabinet manufacturer.
4. Include protection against lightning damage.
5. Have an area inside the cabinet doors for storage of the as-built schematic wiring diagram and irrigation plans.
6. Have padlock clasp or latch and lock mechanism.

20-2.07B(4) Rain Sensors

A rain sensor unit must be a solid state, automatic shut-off type, and compatible with the irrigation controller. The rain sensor unit must automatically interrupt the master remote control valves when approximately 1/8 inch of rain has fallen. The irrigation controller must automatically be enabled again when the accumulated rainfall evaporates from the rain sensor unit collection cup.

Rain sensor units must be one of the following:

1. Rated 24 V(ac) to 30 V(ac)
2. Wireless and FCC compliant

20-2.07C Construction

Finish exposed top surface of concrete pad with a medium broom finish applied parallel to the long dimension.

Locate irrigation controllers in pedestal or wall mounted enclosures as shown.

Install electrical components for automatic irrigation systems under section 86-1.02.

Install irrigation controllers under the manufacturer's instructions and as shown.

If 2 or more irrigation controllers operate the same remote master control valve, furnish and install an isolation relay under the controller manufacturer's instructions.

Where direct burial conductors are to be connected to the terminal strip, connect the conductors with the open-end-crimp-on wire terminals. Exposed wire must not extend beyond the crimp of the terminal and the wires must be parallel on the terminal strip.

Install rain sensor units for irrigation controllers on the irrigation controller enclosure cabinets. Provide protection against lightning damage.

20-2.07D Payment

Payment for electrical service for 120-volt or higher is not included in the payment for irrigation controller.

20-2.08 IRRIGATION CONDUIT

20-2.08A General

20-2.08A(1) Summary

Section 20-2.08 includes specifications for installing irrigation conduit under a roadway or other facility to accommodate electrical conduit for control and neutral conductors and irrigation supply lines.

Before performing work on irrigation systems, locate existing conduits shown to be incorporated into the new work.

Before removing or disturbing existing Type A pavement markers that show the location of the existing conduit, mark the location of the existing conduit on the pavement.

20-2.08A(2) Definitions

Reserved

20-2.08A(3) Submittals

Reserved

20-2.08A(4) Quality Control and Assurance

Demonstrate the conduits are free of obstructions after placement of base and surfacing.

Before and after extending the irrigation supply line in a conduit, pressure test the supply line under section 20-2.01A(4)(b).

After conductors are installed in a conduit, test the conductors under section 20-2.05A(4).

Assign a technical representative to direct and control the directional bore activities. The representative must be present during directional bore activities. Unless otherwise authorized, perform directional bore activities in the presence of the Engineer.

20-2.08B Materials

20-2.08B(1) General

Reserved

20-2.08B(2) ABS Composite Pipe Conduit

ABS composite pipe and couplings must comply with ASTM D 2680. Couplings must be solvent cement type.

20-2.08B(3) Corrugated High Density Polyethylene Pipe Conduit

Corrugated high density polyethylene pipe must comply with ASTM F 405 and F 667 or be Type S and comply with AASHTO M252 and M294. Couplings and fittings must be as recommended by the pipe manufacturer.

20-2.08B(4) Corrugated Steel Pipe Conduit

Corrugated steel pipe conduit must comply with section 66. The nominal thickness of metal sheets for pipe must be 0.064 inch for corrugated steel pipe and 0.060 inch for corrugated aluminum pipe. Coupling bands and hardware must comply with section 66.

20-2.08B(5) Polyvinyl Chloride Pipe Conduit

PVC pipe conduit must be schedule 40 and comply with ASTM D 1785.

Fittings must be schedule 80.

20-2.08B(6) Welded Steel Pipe Conduit

Welded steel pipe must comply with ASTM A 53. Pipe must be black and have either welded or threaded joints.

The minimum wall thickness for the various sizes of welded steel pipe must comply with the dimensions shown in the following table:

Pipe size, nominal (inch)	Minimum wall thickness (inch)
3	0.216
4	0.237
6	0.280
8	0.277
10	0.279
12	0.330

20-2.08C Construction

20-2.08C(1) General

When existing conduits are to be incorporated in new work, excavate exploratory holes for locating existing conduits at the locations indicated by existing markers or as directed. Excavate and backfill exploratory holes to a maximum size of 2-1/2 feet in width, 5 feet in depth, and 5 feet on each side of the marker or directed location parallel to the roadway. If the conduit is not found and if ordered, increase the size of the exploratory holes beyond the dimensions specified. The additional excavation and backfill is change order work.

If extending an existing conduit, remove conductors from the conduit.

Use a coupling band if the new conduit matches the existing conduit diameter, otherwise overlap the conduit at least 12 inches.

After extending existing conduits, install conductors that match the color and size of the existing conductors without splices. Splice conductors in adjacent pull boxes.

If installing a control and neutral conductor and electrical conduit through the irrigation conduit, install a no. 5 pull box at each end.

Remove debris found in the conduit before performing other work. Debris found more than 3 feet from the ends of the conduits is removed as change order work.

Extend conduit 2 feet beyond all paving unless otherwise shown.

Cap the ends of unused conduit.

Designate the location of each conduit by cementing a Type A pavement marker as shown. Type A pavement markers and adhesive must comply with section 85.

20-2.08C(2) Welded Steel Pipe Conduit

20-2.08C(2)(a) General

Install welded steel pipe by directional boring or jack and drill.

Install top of conduits:

1. 18 to 30 inches below the finished surface in sidewalk areas
2. 40 to 52 inches below the finished grade in other paved areas

20-2.08C(2)(b) Directional Boring

Notify the Engineer 2 business days before starting directional bore activities.

The diameter of the boring tool for directional boring must be only as large as necessary to install the conduit.

Mineral slurry or wetting solution may be used to lubricate the boring tool and to stabilize the soil surrounding the boring path. The mineral slurry or wetting solution must be water based.

The directional bore equipment must have directional control of the boring tool and have an electronic boring tool location detection system. During operation, the directional bore equipment must be able to determine the location of the tool both horizontally and vertically.

20-2.08C(2)(c) Jack and Drill

Notify the Engineer 2 business days before starting jack and drill activities.

Jacking or drilling pits must be no closer than 2 feet from pavement edge whenever possible.

If authorized, small holes may be cut in the pavement to locate or remove obstructions.

Do not use excessive water that will soften subgrade or undermine pavement.

20-2.08C(3) Schedule 40 Pipe Conduit

Where schedule 40 pipe conduit 2 inches or less in outside diameter is installed under surfacing, you may install by directional boring under section 20-2.08C(2)(b).

For conduit 2 inches or less in diameter, the top of the conduit must be a minimum of 18 inches below surfacing.

Extend schedule 40 pipe conduit 6 inches beyond surfacing. Cap ends of conduit until used.

20-2.08D Payment

Schedule 40 PVC pipe conduit is paid for as plastic pipe (schedule 40) (supply line).

20-2.09 IRRIGATION SUPPLY LINE

20-2.09A General

20-2.09A(1) Summary

Section 20-2.09 includes specifications for installing irrigation supply line.

If the supply line location interferes with the excavation of plant holes, relocate the plant hole to clear the supply line. Do not install supply lines through plant holes unless shown.

Supply lines, control and neutral conductors and electrical conduits installed in common trenches must not be installed above each other.

20-2.09A(2) Definitions

Reserved

20-2.09A(3) Submittals

Submit a certificate of compliance for polyethylene pipe and plastic pipe supply line.

20-2.09A(4) Quality Control and Assurance

Solvent cement must comply with the local Air Quality Management District requirements.

20-2.09B Materials

20-2.09B(1) General

Irrigation supply pipe must be metal or plastic as shown.

PCC for thrust blocks must be produced from commercial-quality aggregates. The concrete must contain at least 295 pounds of cementitious material per cubic yard.

20-2.09B(2) Copper Pipe Supply Line

Copper pipe must be Type K rigid pipe and comply with ASTM B 88. Fittings must be wrought copper or cast bronze either soldered or threaded.

Solder must be 95 percent tin and 5 percent antimony.

20-2.09B(3) Galvanized Steel Pipe Supply Line

Galvanized steel pipe supply line and couplings must be standard weight and comply with ASTM A 53, except that the zinc coating must not be less than 90 percent of the specified amount. Except for couplings, fittings must be galvanized malleable iron, banded and threaded, and comply with ANSI B16.3, Class 150.

Joint compound must be nonhardening and noncorrosive. Do not use pipe thread sealant tape.

20-2.09B(4) Drip Irrigation Tubing

Drip irrigation tubing must be virgin polyethylene plastic and comply with ASTM D 2737.

The drip irrigation tubing must be distribution tubing with preinstalled in-line emitters.

If preinstalled in-line drip irrigation tubing is not shown, you may install emitters that match the distribution requirements shown. The emitters must be barbed or threaded-type outlet devices with dual silicone diaphragms and installed under the manufacturer's instructions.

The emitters must meet the flow rate and operating pressure range shown.

The wall thickness of polyethylene tubing must comply with the following requirements when tested under ASTM D 2122:

Pipe size, nominal (inch)	Minimum wall thickness (inch)	Maximum wall thickness (inch)
1/2	0.050	0.070
5/8	0.055	0.075
3/4	0.060	0.080

The polyethylene tubing fittings must be leak-free, compression type and have female sockets with an internal barb to provide a positive pipe-to-fitting connection that will not separate at the designed pressure.

20-2.09B(5) Plastic Pipe Supply Line

Plastic pipe supply line must be PVC pipe that is NSF approved.

Schedule 40 plastic pipe supply line must comply with ASTM D 1785.

Class 315 plastic pipe supply line must comply with ASTM D 2241.

PVC gasketed bell joints must comply with ASTM D 2672, ASTM D2241, ASTM D 3139, and ASTM F 477.

For solvent-cemented type joints, the primer and solvent cement must be made by the same manufacturer. The primer color must contrast with the color of the pipe and fittings.

Solvent-cemented fittings must be injection molded PVC, schedule 40, and comply with ASTM D 2466.

Fittings for supply line placed in irrigation conduit must be schedule 80.

Fittings for plastic pipe supply line larger than 4 inches must be ductile iron under section 20-2.14C(2)(b).

If UV-resistant plastic pipe supply line is required, the pipe must be homogeneous, uniform color and be manufactured of:

1. At least 80 percent vinyl chloride resin with UV stabilizers
2. Non-PVC resin modifiers and coloring ingredients
3. Coloring ingredients with UV stabilizers

20-2.09C Construction

20-2.09C(1) General

Cut pipe straight and true. After cutting, ream out the ends to the full inside diameter of the pipe.

Prevent foreign material from entering the irrigation system during installation. Immediately before assembling, clean all pipes, valves, and fittings. Flush lines before attaching sprinklers, emitters, and other terminal fittings.

Pipe supply lines installed between the water meter and backflow preventer assembly must be installed not less than 18 inches below finished grade measured to the top of the pipe.

Where a connection is made to existing supply lines, bell and gasketed fittings or compression fittings may be used.

Install a thrust block at each change in direction on the main supply line, terminus run, and at other locations shown.

Where supply lines cross paved ditches more than 3 feet deep at their flow line, install galvanized steel pipe for the entire span of the ditch.

Secure UV resistant plastic pipe supply line on grade as shown.

20-2.09C(2) Galvanized Steel Pipe Supply Line

Coat male pipe threads on galvanized steel pipe according to the manufacturer's instructions.

20-2.09C(3) Drip Irrigation Tubing

Install drip irrigation tubing on grade and under manufacturer's instructions.

Install a flush valve and an air-relief valve if recommended by the drip valve assembly manufacturer.

20-2.09C(4) Plastic Pipe Supply Line

For PVC pipe 1-1/2 inches in diameter or smaller, cut the pipe with PVC cutters.

For solvent-cemented type joints, apply primer and solvent-cement separately under the manufacturer's instructions.

Wrap the male portion of each threaded plastic pipe fitting with at least 2 layers of pipe thread sealant tape.

Install plastic pipe supply line mains with solvent-cemented type joints not less than 18 inches below finished grade measured to the top of the pipe.

Install plastic pipe supply line laterals with solvent-cemented type joints not less than 12 inches below finished grade measured to the top of the pipe.

Snake plastic pipe installed by trenching and backfilling methods.

20-2.09D Payment

Supply line pipe and drip irrigation tubing are measured along the slope.

20-2.10 SPRINKLER ASSEMBLIES

20-2.10A General

Section 20-2.10 includes specifications for installing sprinkler assemblies.

20-2.10B Materials

20-2.10B(1) General

Each sprinkler assembly must meet the characteristics shown in the irrigation legend.

Where shown, a sprinkler assembly must have a flow shut-off device that automatically stops the flow of water on the downstream side of the device when the assembly is broken. You may use a sprinkler assembly with a preinstalled flow shut-off device or you must install a flow shut-off device under the manufacturer's instructions.

Flexible hose for sprinkler assembly must be leak-free, nonrigid and comply with ASTM D 2287, cell Type 6564500. The hose wall thickness must comply with ASTM D 2122 for the hose diameters shown in the following table:

Hose diameter, nominal (inch)	Minimum wall thickness (inch)
1/2	0.127
3/4	0.154
1	0.179

Solvent cement and fittings for flexible hose must comply with section 20-2.09B(5).

20-2.10B(2) Pop-Up Sprinkler Assemblies

Each pop-up sprinkler assembly must include a body, nozzle, swing joint, pressure compensation device, check valve, sprinkler protector, and fittings as shown.

20-2.10B(3) Riser Sprinkler Assemblies

Each riser sprinkler assembly must include a riser or flexible hose, threaded nipple, swing joint, check valve, and nozzle as shown. The riser must be UV resistant schedule 80, PVC 1120 or PVC 1220 pipe and comply with ASTM D 1785. 11-15-13

20-2.10B(4) Tree Well Sprinkler Assemblies

Each tree well sprinkler assembly must include a body, riser, swing joint, perforated drainpipe, and drain cap.

The perforated drainpipe must be commercial grade, rigid, PVC pipe with holes spaced not more than 6 inches on center on 1 side of the pipe. 07-19-13

Drain cap must be commercially available, 1 piece, injection molded drain grate manufactured from structural foam polyolefins with UV light inhibitors. Drain grate must be black.

Gravel for filling the drainpipe must be graded such that 100 percent passes the 3/4-inch sieve and 100 percent is retained on the 1/2-inch sieve. Gravel must be clean, washed, dry, and free from clay or organic material.

20-2.10C Construction

Install pop-up and riser sprinkler assembly:

1. 6-1/2 to 8 feet from curbs, dikes, and sidewalks
2. 10 feet from paved shoulders
3. 3 feet from fences and walls

If sprinkler assembly cannot be installed within these limits, the location will be determined by the Engineer.

Set sprinkler assembly riser on slopes perpendicular to the plane of the slope.

Install tree well sprinkler assembly as shown.

20-2.10D Payment

Not Used

20-2.11 VALVES

20-2.11A General

Section 20-2.11 includes specifications for installing valves.

20-2.11B Materials

20-2.11B(1) General

Valves must:

1. Include a valve box and cover
2. Be the same size as the supply line that the valve serves unless otherwise shown

3. Be bottom, angled, or straight inlet configuration

20-2.11B(2) Ball Valves

Ball valve must be a two-piece brass or bronze body and comply with the requirements shown in the following table:

Property	Requirements
Nonshock working pressure, min	400 psi
Seats	PTFE
O-ring seals	PTFE

Ball valve must be the same size as the supply line that the valve serves.

20-2.11B(3) Check Valves

Each check valve must:

1. Be schedule 80 PVC and factory set to 5 psi for adjustable spring check valve
2. Be Class 200 PVC for swing check valves on non pressurized plastic irrigation supply line

20-2.11B(4) Drip Valve Assemblies

Each drip valve assembly must include:

1. Remote control valve
2. Wye filter with:
 - 2.1. Filter housing that:
 - 2.1.1. Can withstand a working pressure of 150 psi
 - 2.1.2. Is manufactured of reinforced polypropylene plastic
 - 2.2. Reusable stainless steel filter cartridge with a 200 mesh size filtration
3. Ball valve under 20-2.11B(2)
4. Schedule 80 PVC pipes and fittings
5. Pressure regulator

20-2.11B(5) Garden Valve Assemblies

Each garden valve assembly must have:

1. Garden valve
2. Location marker

20-2.11B(6) Gate Valves

Gate valves must be:

1. Flanged or threaded type
2. Iron or bronze body
3. Bronze trimmed with one of the following:
 - 3.1. Internally threading rising stem
 - 3.2. Nonrising stem
4. Able to withstand a working pressure of 150 psi
5. Same size as the pipeline that the valves serves unless otherwise shown

Gate valves smaller than 3 inches must have a cross handle.

Gate valves 3 inches or larger must be flanged type with a square nut. Furnish 3 long shank keys before Contract acceptance.

Gate valves attached to the outlets of a wye strainer must have seating rings on the discharge side of the gate valves must be PTFE. Valve wedges must be driven obliquely by cam action into the seating rings.

20-2.11B(7) Pressure Regulating Valves

Pressure regulating valve must be:

1. Flanged or threaded type
2. Brass, bronze, cast iron, or plastic body
3. Spring diaphragm type
4. Pilot controlled

Pressure regulating valve must have no internal filter screens.

20-2.11B(8) Pressure Relief Valves

Pressure relief valve must have a brass or bronze body, stainless steel springs, bronze nickel chrome seats, composition seat discs, female bottom inlets, and female side outlets.

20-2.11B(9) Quick Coupling Valves

Quick coupling valve must be 3/4 inch double slotted with a self-closing cap, 3/4-inch brass key and 3/4-inch brass hose swivel unless otherwise shown. Except for the cap, quick coupling valve must be brass or bronze construction. Furnish 3 loose quick coupling brass keys and brass hose swivels before Contract acceptance.

20-2.11B(10) Remote Control Valves

20-2.11B(10)(a) General

Each remote control valve must:

1. Be normally closed type.
2. Be glass filled nylon, brass, or bronze.
3. Be completely serviceable from the top without removing the valve body from the system.
4. Be equipped with a device that regulates and adjusts the flow of water and be provided with a manual shut-off. The manual shut-off for valves larger than 3/4 inch must be operated by a cross handle.
5. Have solenoids compatible with the irrigation controller.
6. Have a manual bleed device.
7. Be capable of withstanding a pressure of 200 psi
8. Have replaceable compression discs or diaphragms.
9. Have threaded fittings for inlets and outlets.
10. Have DC latching solenoids when used with solar or battery controllers. Solenoids must operate on 3.5 V.

20-2.11B(10)(b) Remote Control Valves with Flow Sensor

Reserved

20-2.11B(10)(c) Remote Control Valves with Pressure Regulator

Each remote control valve with pressure regulator must be factory assembled as 1 unit.

20-2.11B(11) Wye Strainer Assemblies

Each wye strainer assembly must include:

1. Wye strainer
2. Garden valve

20-2.11C Construction

20-2.11C(1) General

Install control valves:

1. 6-1/2 to 8 feet from curbs, dikes, and sidewalks
2. 10 feet from paved shoulders
3. 3 feet from fences, walls, or both

If a control valve cannot be installed within these limits, the location will be determined by the Engineer.

20-2.11C(2) Check Valves

Unless otherwise shown, install spring-action check valves as necessary to prevent low head drainage.

20-2.11C(3) Garden Valve Assemblies

Install a location marker 8 to 10 inches from the back of each garden valve.

20-2.11C(4) Pressure Regulating Valves

Install pressure regulating valves with threaded connections and a union on the inlet side of the valves.

20-2.11C(5) Wye Strainer Assemblies

Unless shown, install wye strainer assembly on the upstream side of the remote control valves.

Install garden valve so that when the system is flushed, the discharge sprays out of the valve box.

20-2.11D Payment

Not Used

20-2.12 WATER METERS

Reserved

20-2.13 RESERVED**20-2.14 SUPPLY LINE ON STRUCTURES****20-2.14A General****20-2.14A(1) General****20-2.14A(1)(a) Summary**

Section 20-14 includes specifications for installing water supply lines through bridges and on the exterior of concrete structures.

20-2.14A(1)(b) Definitions

Reserved

20-2.14A(1)(c) Submittals

Submit a work plan for temporary casing support at the abutments as an informational submittal.

20-2.14A(1)(d) Quality Control and Assurance**20-2.14A(1)(d)(i) General**

Before installing seismic expansion assemblies or expansion assemblies, the Engineer must authorize the extension setting.

20-2.14A(1)(d)(ii) Regulatory Requirements

Piping materials must bear the label, stamp, or other markings of the specified standards.

20-2.14A(1)(d)(iii) Site Tests

Test water supply lines before:

1. Backfilling
2. Beginning work on box girder cell decks
3. Otherwise covering the water supply lines

Furnish pipe anchorages to resist thrust forces occurring during testing.

Test the water supply lines as 1 unit. The limits of the unit must be 5 feet beyond the casing at each end of the bridge.

Cap each end of the water supply lines before testing. Caps must be rated for the test pressure.

Test water supply lines under section 20-2.01A(4)(b), except that the testing period must be 4 hours with no pressure drop.

For water supply lines 4 inches and larger testing must meet the following additional requirements:

1. Testing pressure must be at least 120 psi
2. Air relief valve must not be subjected to water pressure due to testing

If water supply lines fail testing, retest the lines after repair.

20-2.14A(2) Materials

20-2.14A(2)(a) General

Protect stored piping from moisture and dirt. Elevate piping above grade. Support piping to prevent sagging and bending.

Protect flanges, fittings, and assemblies from moisture and dirt.

20-2.14A(2)(b) Air Release Valve Assemblies

Air release valve assemblies include an air release valve, ball valve, tank vent, nipples, and pipe saddle. Assemblies must comply with the following:

1. Air release valves must have a cast iron body with stainless steel trim and float, 1-inch NPT inlet, 1/2-inch NPT outlet, and 3/16-inch orifice.
2. Ball valves must have a 2-piece bronze body with chrome plated or brass ball, 1-inch full-size port, and be rated for at least 400 psi.
3. Tank vents must have a 1/2-inch NPT inlet and downward-facing double openings with screened covers.
4. Nipples must be schedule 40 galvanized steel pipe.
5. Pipe saddle must be rated for at least 150 psi and compatible with water supply line. Pipe saddle must be (1) single strap pipe saddle for water supply lines smaller than 4 inches or (2) double strap pipe saddle for water supply lines 4 inches and larger. You may use a tee fitting for galvanized steel water supply lines.

20-2.14A(2)(c) Casings

Casings must be welded steel pipe casing complying with section 70-7.

20-2.14A(2)(d) Pipe Wrap Tape

Pipe wrap tape must be pressure sensitive tape made from PVC or polyethylene. Pipe wrap tape must be at least 50 mils thick and not wider than 2 inches.

20-2.14A(2)(e) Pipe Hangers

Pipe hangers must comply with section 70-7.02C.

The pipe hanger must be rated for the water supply line. If casings are shown, include the casings weight.

20-2.14A(2)(f) Epoxy Adhesives

Epoxy used for anchoring concrete pipe supports must comply with section 70-7.02D.

20-2.14A(2)(g) Concrete Pipe Supports

Concrete pipe supports must comply with section 70-7.02D.

20-2.14A(2)(h) Pipe Clamps and Anchors

Metal clamps must be commercial quality steel complying with section 75-1.02. Anchors must comply with the specifications for concrete anchorage devices in section 75-1.03C.

20-2.14A(2)(i) Pull Boxes

Pull boxes and covers must comply with section 20-2.01B(5).

20.2.14A(3) Construction

20-2.14A(3)(a) General

Support water supply lines as described.

Where water supply lines penetrate bridge superstructure concrete, either form or install pipe sleeves at least 2 pipe sizes larger than the pipe.

20-2.14A(3)(b) Preparation

Clean the interior of the pipe before installation. Cap or plug openings as pipe is installed to prevent the entrance of foreign material. Leave caps or plugs in place until the next pipe section is installed.

20-2.14A(3)(c) Installation**20-2.14A(3)(c)(i) General**

Reserved

20-2.14A(3)(c)(ii) Casings

Install casings under section 70-7.03.

Seal casing end with 8 inches of polyurethane foam at dirt stop or pipe end seal.

20-2.14A(3)(c)(iii) Wrapping Water Supply Line

Wrap damaged supply line coatings with pipe wrap tape. Wrap field joints and fittings that are in contact with the earth.

Wrapping must comply with the following:

1. Clean and prime area as recommended by the tape manufacturer.
2. Tightly wrap tape with 1/2 uniform overlap, free from wrinkles and voids, to provide not less than a 100 mil thickness.
3. The tape must conform to joint or fitting contours.
4. Extend tape at least 6 inches over adjacent pipe.

20-2.14A(3)(c)(iv) Pipe Clamps and Anchors

Install water supply lines on the exterior surfaces of bridges or other concrete structures with metal clamps and anchors.

Drilling of holes for anchors must comply with the following:

1. Drill holes to manufacturers recommended depth.
2. Drilling tools must be authorized.
3. Do not drill holes closer than 6 inches to the edge of a concrete structure.
4. Relocate holes if reinforcing steel is encountered. Fill abandoned holes with mortar. Mortar must comply with section 51-1.02F.

Where water supply lines are mounted vertically for more than 2 feet, install clamps and anchors within 6 inches of the elbows.

Where water supply lines are mounted vertically for more than 10 feet, install additional clamps and anchors at 10 foot centers unless otherwise shown.

20-2.14A(3)(d) Sequences of Operation

If the bridge superstructure is to be prestressed do not place mortar around casings in abutments and hinges until bridge superstructure prestressing has been completed.

20-2.14A(4) Payment

Supply line on structures is measured from end to end, along the centerline.

The Department does not pay for failed tests.

20-2.14B Supply Line on Structures, Less than 4 Inches**20-2.14B(1) General****20-2.14B(1)(a) Summary**

Section 20-2.14B includes specifications for installing water supply lines smaller than 4 inches.

20-2.14B(1)(b) Definitions

Reserved

20-2.14B(1)(c) Submittals

Product data for materials includes catalog cuts, performance data, and installation instructions.

Submit product data for:

1. Water supply line
2. Expansion assemblies
3. Casing insulators
4. Pipe end seals
5. Pipe anchorages
6. Air release valve assemblies
7. Casings
8. Pipe hangers
9. Epoxy adhesives
10. Concrete pipe supports

20-2.14B(1)(d) Quality Control and Assurance

Reserved

20-2.14B(2) Materials

20-2.14B(2)(a) General

Reserved

20-2.14B(2)(b) Water Supply Line

Water supply lines must comply with section 20-2.09.

20-2.14B(2)(c) Expansion Assemblies

Expansion assemblies must consist of a hose with ends, insulated flange connections, and elbows. Expansion assemblies must have the same nominal inside diameter as the water supply line. Working pressure must be at least 150 psi.

Hose must be medium or heavy weight, crush and kink resistant, rated for at least 150 psi. Cover must be flexible, oil resistant rubber or synthetic, reinforced with at least 2-ply synthetic yarn or steel wire. The inner tube must meet FDA and USDA Standards for potable water. Hose ends must be stainless steel flanged connections with stainless steel crimped bands or swaged end connectors. Do not use barbed ends with band clamps.

Elbows must be 45 degree, standard weight galvanized steel fittings.

20-2.14B(2)(d) Casing Insulators

Casing insulators must be:

1. 2-piece, high-density, injection-molded polyethylene, nonconductive inner liner, with cadmium-plated nuts and bolts.
2. Factory constructed to ensure the water supply line is centered in the casing. Insulators must not allow any contact between pipe and casing and have at least 2 runners seated on the bottom of the casing.
3. Sized for the casing and water supply line shown.

20-2.14B(2)(e) Pipe Anchorages

Pipe anchorages must consist of an I-beam, U-bolts, anchors, and double nuts.

Use concrete anchorage devices for anchors on existing bridges. Use L-anchor bolts for anchors on new bridges.

Fabricate the I-beam from 1/2-inch steel plate. Steel plate, U-bolts, L-anchors, and nuts must comply with section 75-1.02. Concrete anchorage devices must comply with section 75-1.03C.

20-2.14B(2)(f) Pipe End Seals

Pipe end seals must consist of a pipe end seal, stainless steel bands, and polyurethane foam.

Pipe end seal must be factory constructed from seamless neoprene and sized for the casing and water supply line shown. Neoprene must be at least 1/8 inch thick. Stainless steel bands must be crimped.

Polyurethane foam must be expanding foam spray that is water resistant and moisture cured.

20-2.14B(3) Construction

Locate pipe anchorage halfway between expansion assemblies.

Pipe end seal must be pulled onto the casing during pipe installation. Do not use wrap-around type end seals.

20-2.14B(4) Payment

Supply line on structures is paid for as galvanized steel pipe (supply line on bridge).

20-2.14C Supply Line on Structures, 4 Inches and Larger

20-2.14C(1) General

20-2.14C(1)(a) Summary

Section 20-2.14C includes specifications for installing water supply lines 4 inches and larger.

20-2.14C(1)(b) Definitions

Reserved

20-2.14C(1)(c) Submittals

Product data for materials includes catalog cuts, performance data, and installation instructions.

Submit product data for:

1. Water supply line
2. Expansion assemblies
3. Flange insulating gaskets
4. Casing insulators
5. Seismic expansion assemblies
6. Lateral restraint assemblies
7. Air release valve assemblies
8. Casings
9. Pipe hangers
10. Epoxy adhesives
11. Concrete pipe supports

Submit the maximum range and preset dimension for each expansion assembly or seismic expansion assembly as an informational submittal.

Submit at least 5 sets of product data to OSD, Documents Unit. Each set must be bound together and include an index stating equipment names, manufacturers, and model numbers. Two sets will be returned. Notify the Engineer of the submittal. Include in the notification the date and contents of the submittal.

20-2.14C(1)(d) Quality Control and Assurance

Reserved

20-2.14C(2) Materials

20-2.14C(2)(a) General

Reserved

20-2.14C(2)(b) Water Supply Line

Water supply lines must consist of ductile iron pipe and fittings. Pipe must comply with ANSI/AWWA C151/A21.51, Class 350. Fittings must comply with ANSI/AWWA C110/A21.10, rated for a working pressure of 350 psi.

Ductile iron pipe connections to expansion assemblies must be a flanged joint complying with ANSI/AWWA C115/A21.15. Flange gaskets must be rated for a working pressure of 350 psi. Fasteners must comply with section 75-1.02, except that stainless steel fasteners must not be used.

All other ductile iron pipe and fitting joints must be push-on, restrained type complying with ANSI/AWWA C111/A21.11. Push-on, restrained type joints may use proprietary dimensions and proprietary restrained joint locking systems.

Ductile iron pipe and fittings must have an asphaltic coating complying with ANSI/AWWA C151/A21.51, and a cement mortar lining complying with ANSI/AWWA C104/A21.4.

20-2.14C(2)(c) Expansion Assemblies

Expansion assemblies must be a sleeve type expansion joint. The expansion assembly must have:

1. Ductile iron body complying with ANSI/AWWA C153/A21.53
2. Flanged ends complying with ANSI/AWWA C110/A21.10
3. Fusion bonded epoxy internal lining complying with ANSI/AWWA C213 at least 15 mils thick
4. Internal expansion sleeve limiting stop collars and be pressure balanced
5. Working pressure of at least 350 psi for sizes 24 inches and smaller and 250 psi for sizes larger than 24 inches
6. NSF 61 certification

The expansion assembly must be factory set at 1/2 the extension capacity.

20-2.14C(2)(d) Flange Insulating Gaskets

Flange insulating gaskets must consist of a dielectric flange gasket, insulating washers and sleeves, and commercial quality steel bolts and nuts. Dielectric flange gasket must have a dielectric strength of at least 500 vpm.

20-2.14C(2)(e) Casing Insulators

Casing insulators must be:

1. 2-piece, 8-inch, 14-gauge epoxy-coated or galvanized steel band, four 2-inch-wide glass-reinforced polyester or polyethylene runners, with cadmium-plated nuts and bolts.
2. Coated with at least 15-mils heat-fused PVC to provide a nonconductive inner liner.
3. Factory constructed to ensure the water supply line is centered in the casing. Insulators must not allow any pipe to casing contact and have at least 2 runners seated on the bottom of the casing.
4. Sized for the casing and water supply line shown.

20-2.14C(2)(f) Dirt Stops

Dirt stops must consist of a redwood cover with polyurethane foam.

Use construction heart grade redwood complying with 57-2.01B(2). Construct cover to fit snugly around the water supply line. The cover must be 2 inches taller and 2 inches wider than the casing.

Polyurethane foam must be expanding foam spray that is water resistant and moisture cured.

20-2.14C(2)(g) Seismic Expansion Assemblies

Seismic expansion assemblies must be a sleeve type expansion joint with integral ball joints at each end.

Seismic expansion assemblies must have:

1. Ability to withstand at least 15 degree angular deflection at each end and maximum movement in all 3 planes at the same time
2. Ductile iron body complying with ANSI/AWWA C153/A21.53
3. Flanged ends complying with ANSI/AWWA C110/A21.10
4. Fusion bonded epoxy internal lining complying with ANSI/AWWA C213 at least 15 mils thick
5. Internal expansion sleeve limiting stop collars and pressure balanced
6. Ball joints contained in flanged retainers with seal gaskets
7. Working pressure of at least 350 psi for sizes 24 inches and smaller and 250 psi for sizes larger than 24 inches

8. NSF 61 certification

The seismic expansion assembly must be factory set at 1/2 the extension capacity.

20-2.14C(2)(h) Lateral Restraint Assemblies

Lateral restraint assemblies must be (1) constructed from commercial quality steel components complying with section 75-1.02, (2) adjustable, and (3) able to resist a horizontal force of 10 percent of the contributory dead load.

20-2.14C(3) Construction

Each ductile iron pipe must be connected and fully extended (pulled out) after joint assembly before the next pipe section is added.

Install flange insulating gaskets on the outside flange of seismic expansion assemblies and expansion assemblies.

20-2.14C(4) Payment

Supply line on structures is paid for as supply line (bridge).

20-2.15 TEMPORARY IRRIGATION SYSTEMS

Reserved

20-2.16–20-2.19 RESERVED

20-3 PLANTING

20-3.01 GENERAL

20-3.01A General

20-3.01A(1) Summary

Section 20-3 includes specifications for performing planting work in new and existing landscapes.

20-3.01A(2) Definitions

Reserved

20-3.01A(3) Submittals

20-3.01A(3)(a) General

Submit nursery invoices showing species or variety and inspection certificates for plants.

Submit documentation of clearance from the county agricultural commissioner for plants obtained from a county outside the project limits.

If a root stimulant is required, submit a copy of the root stimulant manufacturer's product sheet and instructions for the application of the root stimulant.

If cuttings are to be taken from outside the right-of-way, submit proof of permits and payment of associated fees. Notify the Engineer of the location at least 15 days before taking cuttings.

20-3.01A(3)(b) Vendor Statements

At least 60 days before planting the plants, submit a statement from the vendor that the order for the plants required, including sample plants used for inspection, has been received and accepted by the vendor. The statement from the vendor must include the plant names, sizes, and quantities and the anticipated delivery date.

20-3.01A(3)(c) Certificates of Compliance

Submit a certificate of compliance for:

1. Sod
2. Soil amendment

20-3.01A(4) Quality Control and Assurance

Plants must comply with federal and state laws requiring inspection for diseases and infestations. Inspection certificates required by law must accompany each shipment of plants.

Obtain clearance from the county agricultural commissioner before planting plants delivered from a county outside the project limits.

The Engineer inspects the roots of container-grown sample plants by removing earth from the rootball of not less than 2 plants, nor more than 2 percent of the total number of plants of each species or variety. If container-grown plants are purchased from several sources, the Engineer inspects the roots of not less than 2 of each sample plant species or variety from each source. The rootball of container grown plants must not show evidence of being underdeveloped, deformed, or having been restricted.

If the Engineer finds noncompliant plants, the entire lot represented by the noncompliant sample plants will be rejected.

Cuttings with mature or brown stems and cuttings that have been trimmed will be rejected.

20-3.01B Materials

20-3.01B(1) General

Notify the Engineer at least 10 days before the plants are shipped to the job site.

20-3.01B(2) Plants

20-3.01B(2)(a) General

Plants must be the variety and size shown and true to the type or name shown. Plants must be individually tagged or tagged in groups identifying the plants by species or variety. Tagging is not required for cuttings.

Plants must be healthy, well-formed, not root-bound, free from insect pests and disease, and grown in nurseries inspected by the Department of Food and Agriculture.

The plants must comply with the size and type shown in the following table:

Plant group designation	Description	Container size (cu in)
A	No. 1 container	152–251
B	No. 5 container	785–1242
C	Balled and burlapped	--
E	Bulb	--
F	In flats	--
H	Cutting	--
I	Pot	--
K	24-inch box	5775–6861
M	Liner ^a	--
O	Acorn	--
P	Plugs ^{a, b}	--
S	Seedling ^c	--
U	No. 15 container	2768–3696

^aDo not use containers made of biodegradable material.

^bGrown in individual container cells.

^cBare root.

Trucks used for transporting plants must be equipped with covers to protect plants from windburn.

Handle and pack plants in an authorized way for the species or variety.

20-3.01B(2)(b) Cuttings

20-3.01B(2)(b)(i) General

Take cuttings at random from healthy, vigorous plants. Make cuts with sharp, clean tools. Do not take more than 25 percent of an individual plant and not more than 50 percent of the plants in an area.

Keep cuttings covered and wet until planted. Do not allow cuttings to dry or wither.

Plant cuttings no more than 2 days after being cut.

20-3.01B(2)(b)(ii) *Carpobrotus* and *Delosperma* Cuttings

You may take cuttings for new *Carpobrotus* and *Delosperma* groundcover from the existing highway planting areas, but these areas may not provide enough material to complete the work. Contact the local District's encroachment permit office to obtain a permit to harvest cuttings, identify acceptable cutting harvest areas, and to determine acceptable quantities to take.

Take tip cuttings from healthy, vigorous *Carpobrotus* and *Delosperma* plants that are free of pests and disease.

Carpobrotus cuttings must be 10 inches or more in length and not have roots.

Delosperma cuttings must be 6 inches or more in length and not have roots.

20-3.01B(2)(b)(iii) Willow Cuttings

Take willow cuttings from areas shown or designated by the Engineer.

Willow cuttings must be:

1. Reasonably straight
2. 20 to 24 inches in length
3. 3/4 to 1-1/2 inch in diameter at the base of the cutting

Cut the top of each willow cutting square above a leaf bud. Cut the base below a leaf bud at approximately a 45 degree angle. Trim off leaves and branches flush with the stem of the cutting.

20-3.01B(2)(b)(iv) Cottonwood Cuttings

Cottonwood cuttings must comply with the requirements for willow cuttings in section 20-3.01B(2)(b)(iii).

20-3.01B(2)(b)(v)–20-3.01B(2)(b)(viii) Reserved

20-3.01B(2)(c) Sod

Sod must:

1. Be grown to comply with the Food & Agri Code
2. Be free from weeds and undesirable types of grasses and clovers
3. Be field-grown on soil containing less than 50 percent silt and clay
3. Have less than 1/2-inch-thick thatch
4. Not be less than 8 months or more than 16 months old
5. Be machine-cut to a uniform soil thickness of $5/8 \pm 1/4$ inch, not including top growth and thatch

Protect sod with tarps or other protective covers during delivery. Do not allow sod to dry out during delivery or before placement.

20-3.01B(3) Soil Amendment

Soil amendment must comply with the requirements in the Food & Agri Code. Soil amendment must be one or a combination of the following:

1. Sphagnum peat moss
2. Nitrolized fir bark
3. Vermiculite
4. Perlite

20-3.01B(4) Fertilizers

20-3.01B(4)(a) General

Deliver fertilizer in labeled containers showing weight, chemical analysis, and manufacturer's name.

Fertilizer must comply with the requirements of the Food & Agri Code.

20-3.01B(4)(b) Slow-release Fertilizers

Slow-release fertilizer must be a pelleted or granular form with a nutrient release over an 8 to 12 month period and must comply with the chemical analysis ranges shown in the following table:

Ingredient	Content (percent)
Nitrogen (N)	16–21
Phosphoric acid (P)	6–8
Water soluble potash (K)	4–10

20-3.01B(4)(c) Packet Fertilizers

Packet fertilizer must be a biodegradable packet with a nutrient release over a 12 month period. Each packet must have a weight of 10 ± 1 grams and must comply with the chemical analysis shown in the following table:

Ingredient	Content (percent)
Nitrogen(N)	20
Phosphoric acid (P)	10
Water soluble potash (K)	5

20-3.01B(4)(d) Organic Fertilizers

Organic fertilizer must be pelleted or granular with a cumulative nitrogen release rate of no more than 70 percent for the first 70 days after incubation at 86 degrees F with 100 percent at 350 days or more.

Organic fertilizer must comply with the chemical analysis shown in the following table:

Ingredient	Content (percent)
Nitrogen (N)	5–7
Phosphoric acid (P)	1–5
Water soluble potash (K)	1–10

20-3.01B(5) Root Stimulants

Root stimulant must be a commercial quality product.

20-3.01B(6) Plaster Sand

Backfill material for the transplant palm tree planting holes must be 100 percent commercial quality washed plaster sand.

20-3.01B(7) Root Barrier

Root barrier must be an injection molded or extruded modular panel made of high-density polypropylene or polyethylene plastic.

Each panel must:

1. Be at least 1/16-inch thick
2. Have at least 4 molded root-deflecting vertical ribs 0.5- to 0.8-inch wide, 6 to 8 inches apart
3. Have a locking strip or an integral male-female sliding lock designed to resist slippage between panels
4. Be at least 2 feet wide and 2 feet in depth

20-3.01B(8) Root Protectors

Each root protector must be:

1. Fabricated from 1-inch, hexagonal pattern, 20-gauge mesh wire
2. Closed bottom design with a height and diameter that provides a minimum of 6 inches of clearance between the root ball and the sides and bottom of the wire cylinder

Wire edges at the top of the cylinder must be the uncut manufactured finished edge free of sharp points.

20-3.01B(9) Foliage Protectors

Each foliage protector must be:

1. Fabricated from 1-inch, hexagonal pattern, 20-gauge mesh wire
2. Approximately 4 feet high and 2 feet in diameter

Wire edges at the top of the cylinder must be the uncut manufactured finished edge free of sharp points. Other wire edges that are cut must be free of sharp points.

Support stakes must be one of the following:

1. 3/4-inch reinforcing steel bar a minimum of 5 feet long with an orange or red plastic safety cap that fits snugly onto the top of the reinforcing steel bar
2. 2 inch nominal diameter or 2 by 2 inch nominal size wood stakes a minimum of 5 feet long. Wood stakes must be straight

The jute mesh cover must comply with section 21-1.02O(2). Twine required to hold the jute mesh cover in place must be 1/8-inch diameter manila hemp twine.

20-3.01B(10) Wood Plant Stakes

Each plant stake must be nominal 2 by 2 inch or nominal 2-inch diameter and of sufficient length to keep the plant in an upright position.

Plant stakes for vines must be nominal 1 by 1 inch, 18 inches long.

20-3.01B(11) Plant Ties

Plant ties must be extruded vinyl-based tape, 1 inch wide and at least 10 mils thick.

20-3.01C Construction

20-3.01C(1) General

Apply a root stimulant under the manufacturer's instructions to the plants specified in the special provisions.

Before transporting the plants to the planting area, thoroughly wet the root ball.

20-3.01C(2) Pruning

Prune plants under the latest edition of ANSI A300 part 1, *Pruning*, published by the Tree Care Industry Association.

Do not use tree seal compounds to cover pruning cuts.

20-3.01C(3) Watering

Water existing plants to be maintained, transplanted trees, and new plants as needed to keep the plants in a healthy growing condition.

20-3.01C(4) Replacement Plants

Plants that show signs of failure to grow at any time or are so injured or damaged as to render them unsuitable for the purpose intended, must be removed, replaced, and replanted. Replace unsuitable plants within 2 weeks after the Engineer marks or indicates that the plants must be replaced.

Replacement planting must comply with the original planting requirements, spacing, and size provisions described for the plants being replaced.

Replacement planting for transplanted trees must comply with the work plan and be planted in the same planting hole.

Replacement ground cover plants must be the same species specified for the ground cover being replaced. Other replacement plants must be the same species as the plants being replaced.

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

The Department does not pay for replacement plants or the planting of replacement plants.

20-3.01C(5) Maintain Plants

Maintain plants from the time of planting until Contract acceptance if no plant establishment period is specified or until the start of the plant establishment period.

20-3.01D Payment

Reserved

20-3.02 EXISTING PLANTING

20-3.02A General

20-3.02A(1) Summary

Section 20-3.02 includes specifications for pruning existing plants, transplanting trees, and maintaining existing planted areas.

Transplant palm trees between March 15 and October 15.

20-3.02A(2) Definitions

Reserved

20-3.02A(3) Submittals

Submit a work plan for:

1. Transplanting trees. The work plan must include methods for lifting, transporting, storing, planting, guying, and maintaining each tree to be transplanted. Include root ball size, method of root ball containment, and a maintenance program for each tree.
2. Maintaining existing planted areas. The work plan must include weed control, fertilization, mowing and trimming of turf areas, watering, and controlling rodents and pests.

Submit a copy of the manufacturer's product sheet for root stimulant including application instructions.

20-3.02A(4) Quality Control and Assurance

Inspect for deficiencies of existing planted areas in the presence of the Engineer. Complete the inspection within 15 days after the start of job site activities.

Deficiencies requiring corrective action include:

1. Weeds
2. Dead, diseased, or unhealthy plants
3. Missing plant stakes and tree ties
4. Inadequate plant basins and basin mulch
5. Other deficiencies needing corrective action to promote healthy plant life
6. Rodents and pests

20-3.02B Materials

Not Used

20-3.02C Construction

20-3.02C(1) General

Correct deficiencies of existing planted areas as ordered within 15 days of the order. Correction of deficiencies is change order work.

After deficiencies are corrected, perform work to maintain existing planted areas in a neat and presentable condition and to promote healthy plant growth through Contract acceptance.

20-3.02C(2) Prune Existing Plants

Prune existing plants as shown.

If no bid item for prune existing plants is included, prune existing plants as ordered. Pruning existing plants is change order work.

20-3.02C(3) Transplant Trees

Prune each tree to be transplanted immediately before lifting.

If the tree to be transplanted is a palm, prune by removing dead fronds and frond stubs from the trunk. Remove green fronds up to 2 rows of fronds away from the center of growth. Tie the remaining 2 rows of fronds in an upright position with light hemp or manila rope. Remove fronds and frond stubs at the trunk in a manner that will not injure the trunk. Remove fronds and frond stubs for *Phoenix dactylifera* (Date Palm) approximately 4 inches from the trunk.

Prepare each hole in the new location before lifting the tree to be transplanted.

Lift tree to be transplanted as described in the work plan.

Comply with section 20-3.03C(3) for handling and planting each tree to be transplanted.

Until replanted, cover exposed root ball with wet burlap or canvas and cover the crown with 90 percent shade cloth.

Replant each tree on the same day it is lifted if possible. If the transplant location is not ready to receive the tree, store and maintain the tree to be transplanted until the transplant location is authorized. Store tree in an upright position.

Replace damaged transplanted tree under 20-3.01C(4) and with the number of trees specified in the special provisions.

The replacement trees must be planted in individual plant holes at the location determined by the Engineer within the area of the tree being replaced. Comply with section 20-3.03C(2) for the planting of the replacement trees.

20-3.02C(4) Maintain Existing Planted Areas

If a bid item for maintain existing planted areas is included, the existing plant basins must be kept well-formed and free of sediment. If the existing plant basins need repairs, and the basins contain mulch, replace the mulch after the repairs are done.

Control weeds within the existing planted area and:

1. From the existing planted area limit to the adjacent edges of paving and fences if less than or equal to 12 feet
2. From the existing planted area limit to 6 feet beyond the outer limit of the existing planted area if the adjacent edge of paving or fence is more than 12 feet away
3. Within a 3-foot radius from each existing tree and shrub

If no bid item for maintain existing planted areas is included, maintain existing planted areas as ordered. Maintain existing planted areas is change order work.

20-3.02D Payment

Not Used

20-3.03 PLANTING WORK

20-3.03A General

Section 20-3.03 includes specifications for planting plants.

20-3.03B Materials

Not Used

20-3.03C Construction

20-3.03C(1) General

Do not begin planting until authorized.

If an irrigation system is required, do not begin planting in an area until the functional test has been completed and authorized for the irrigation system serving that area.

20-3.03C(2) Preparing Planting Areas

The location of each plant is as shown unless the Engineer designates otherwise. If the Engineer designates the location, it will be marked by a stake, flag, or other marker.

Conduct work so the existing flow line in drainage ditches is maintained. Material displaced by your operations that interferes with drainage must be removed.

Where a minimum distance to a drainage ditch is shown, locate the plant so that the outer edge of its basin wall is at least the minimum distance shown for each plant involved.

Excavate each planting hole by hand digging or by drilling. The bottom of each planting hole must be flat. Do not use water for excavating the hole.

Unless a larger planting hole is specified, the planting hole must be large enough to receive the root ball or the total length and width of roots, backfill, amendments, and fertilizer. Where rock or other hard material prohibits the hole from being excavated, a new hole must be excavated and the abandoned hole backfilled.

20-3.03C(3) Planting Plants

20-3.03C(3)(a) General

Do not plant plants in soil that is too wet, too dry, not properly conditioned as specified, or in an unsatisfactory condition for planting.

Do not distribute more plants than can be planted and watered on that day.

Water plants immediately after planting. Apply water until the backfill soil around and below the roots or ball of earth around the roots of each plant is thoroughly saturated. When watering with a hose, use a nozzle, water disbursement device, or pressure reducing device. Do not allow the full force of the water from the open end of the hose to fall within the basin around any plant. Groundcover plants in areas with an irrigation system must be watered by sprinklers. Several consecutive watering cycles may be necessary to thoroughly saturate the soil.

If shown, install root barriers between trees and concrete sidewalk or curb. Install panels flush with finished grade and join with locking strips or integral male-female sliding locks. Install barriers with root deflectors facing inward.

If a tree grate is shown, install root barrier panels 0.5 inch above finish grade or as shown.

Adjust planting locations so that each tree or shrub is at least 8 feet away from any sprinkler.

Where a tree, shrub, or vine is to be planted within a groundcover area or cutting planting area, plant it before planting groundcover or cuttings.

Where shrubs and groundcovers are shown to be planted in groups, the outer rows directly adjacent to the nearest roadway or highway fence must be parallel to the nearest roadway or highway fence. Stagger shrubs and groundcovers in adjacent rows. Adjust the alignment of the plants within the outer rows.

Core holes in concrete masonry block wall as shown.

Where a vine is to be planted against a wall or fence, plant it as close as possible to the wall or fence. If a vine planted next to a wall is to be staked, stake and tie the vine at the time of planting. A vine planted next to a fence must be tied to the fence at the time of planting.

Protect tree trunks from injury. Do not:

1. Drag tree
2. Use chains to move a tree
3. Lay tree on the ground

20-3.03C(3)(b) Trees, Shrubs, and Vines

After preparing holes, thoroughly mix soil amendment and granular fertilizer at the rate shown with native soil to be used as backfill material. Remove containers from plants in such a manner that the ball of earth surrounding the roots is not broken. Do not cut plant containers before delivery of the plants to the planting area. Plant and water plants immediately after removal from their containers.

Place packet fertilizer in the backfill within 6 to 8 inches of the ground surface and approximately 1 inch from the root ball. If more than 1 packet is required per plant, distribute the packets evenly around the root ball.

If a root stimulant is to be used, apply it according to the manufacturer's instructions.

If required, install root protectors in the plant holes as shown.

Ensure roots are not restricted or distorted.

Distribute backfill uniformly throughout the entire depth of the plant hole without clods or lumps. After the planting holes have been backfilled, jet water into the backfill with a pipe or tube inserted into the bottom of the hole until the backfill material is saturated for the full depth. If the backfill material settles below this level, add additional backfill to the required level. If a plant settles deeper than shown, replant it at the required level.

Remove nursery stakes after planting.

Install 2 plant stakes for each plant to be staked at the time of planting as shown. Ensure the rootball is not damaged.

Tie the plant to the stakes with 2 plant ties, 1 tie to each stake. Each tie must form a figure 8 by crossing the tie between the plant and the stake as shown. Install ties at the lowest position that will support the plant in an upright position. Ties must provide trunk flexibility but not allow the trunk to rub against the stakes. Wrap each end of the tie 1-1/2 turns around the stake and securely tie.

Construct a watering basin around each plant as shown.

If required, install a foliage protector:

1. Over the plant within 2 days after planting.
2. Vertically and centered over the plant as shown

If foliage protectors are required:

1. Cut the bottom of the wire cylinder to match the slope of the ground. Do not leave sharp points of wire after cutting. Sharp points must be bent over or blunted.
2. Install 2 support stakes for foliage protectors vertically and embed in the soil on opposite sides of the plant as shown and in a transverse direction to the prevailing wind.
3. Either weave the support stakes through the wire cylinder mesh at 6 inch maximum centers or fasten the wire cylinder to the support stakes at 6 inch maximum centers.
4. Wire cylinder must be snug against the support stakes but loose enough to be raised for pesticide application or to perform weeding within the plant basin.
5. Install jute mesh cover over the foliage protector and secure with twine as shown.

20-3.03C(3)(c) Groundcover Plants

Each groundcover planting area irrigated by a single control valve must be completely planted and watered before planting other groundcover planting areas.

Plant groundcover plants in moist soil, and in neat, straight rows, spaced as shown.

Apply fertilizer to groundcover plants and water into the soil immediately after planting.

20-3.03C(3)(d) Cuttings, Liners, Plugs, and Seedling Plants

20-3.03C(3)(d)(i) General

Apply fertilizer to cuttings, liners, plugs, and seedling plants and water immediately after planting.

Ensure the soil is moist to a minimum depth of 8 inches before planting cuttings.

If a root stimulant is to be used, apply it according to the manufacturer's instructions.

20-3.03C(3)(d)(ii) Willow Cuttings

Unless otherwise shown, for willow cuttings excavate planting holes perpendicular to the ground line by using a steel bar, auger, post hole digger, or similar tools. Holes must be large enough to receive the cuttings and fertilizer packet. Plant willow cuttings to the specified depths without damaging the bark.

Where rock or other hard material prohibits the excavation of the planting holes, excavate new holes and backfill the unused holes.

Plant willow cuttings during the period specified in the special provisions.

Apply root stimulant according to the manufacturer's instructions.

Plant the base of the cutting 10 to 12 inches deep with 3 to 5 bud scars exposed above the ground. If more than 5 bud scars are exposed, trim off the excess willow cutting length.

Place 1 fertilizer packet in the backfill of each cutting, 6 to 8 inches below the ground surface and approximately 1 inch from the cutting.

Backfill the plant holes with excavated material after planting. Distribute the excavated material evenly within the hole without clods, lumps, or air pockets. Compact the backfill so that the cutting cannot be easily removed from the soil. Do not damage the cutting's bark.

Dispose of trimmings and unused cuttings.

20-3.03C(3)(d)(iii) Cottonwood Cuttings

Reserved

20-3.03C(3)(d)(iv) *Carpobrotus* and *Delosperma* Cuttings

Plant *Carpobrotus* cuttings to a depth so that not less than 2 nodes are covered with soil. The basal end of *Delosperma* cuttings must not be less than 2 inches below the surface of the soil and the basal end of *Carpobrotus* cuttings must not be less than 4 inches below the surface of the soil.

Apply root stimulant to *Delosperma* cuttings before planting.

Do not plant *Carpobrotus* or *Delosperma* cuttings in soil that does not contain sufficient moisture at an average depth of 2 inches below the surface.

20-3.03C(3)(d)(v) Liner Plants

Plant liner plants during the period specified in the special provisions.

If a foliage protector is required, install under section 20-3.03C(3)(b).

20-3.03C(3)(d)(vi) Plug Plants

Plant plug plants during the period specified in the special provisions.

20-3.03C(3)(d)(vii) Seedling Plants

Plant seedling plants during the period specified in the special provisions.

20-3.03C(3)(e) Sod

After all other planting is performed, grade sod areas to drain and to a smooth and uniform surface. Fine grade and roll sod areas before placing sod.

Areas adjacent to sidewalks, edging, and other paved borders and surfaced areas must be 1 inch below the finished surface elevation of the facilities, after fine grading, rolling, and settlement of the soil.

Place sod such that the end of each adjacent strip is staggered a minimum of 2 feet. Place the edge and end of sod firmly against adjacent sod and against sidewalks, edging, and other paved borders and surfaced areas.

Lightly roll the entire sodded area to eliminate air pockets and ensure close contact with the soil after placement of sod. Water the sodded areas so that the soil is moist to a minimum depth of 4 inches after rolling. Do not allow the sod to dry out.

If irregular or uneven areas appear in the sodded areas, restore to a smooth and even appearance.

Trim sod to a uniform edge at sidewalks, edging, and other paved borders and surfaced areas. Trimming must be repeated whenever the edge of sod extends 1 inch beyond the edge of the edging, sidewalks, and other paved borders and surfaced areas. Remove and dispose of trimmed sod.

Mow sod when it has reached a height of 4 inches. Mow sod to a height of 2.5 inches.

20-3.03D Payment

Soil amendment is measured in the vehicle at the point of delivery.

Measurement for slow-release fertilizer, organic fertilizer, or iron sulfate is determined from marked weight or sack count.

Various sizes and types of plants are measured by either the product of the average plant density and the total area planted or by actual count of the living plants in place, determined by the Engineer. The average plant density is the number of living plants per sq yd determined from actual count of test areas chosen representing the total planted area. The size and location of the test areas is determined by you and the Engineer, except that the total area tested must be equal to not less than 3 percent nor more than 5 percent of the planted area being determined. The Engineer makes the final determination of the areas to be tested.

20-3.04–20-3.08 RESERVED

20-4 PLANT ESTABLISHMENT WORK

20-4.01 GENERAL

20-4.01A Summary

Section 20-4 includes specifications for performing plant establishment work.

Plant establishment consists of caring for the plants, including watering, fertilizing, pruning, replacing damaged plants, pest control, and operating and repairing of all existing irrigation facilities used and irrigation facilities installed as part of the new irrigation system.

Working days on which no work is required, as determined by the Engineer, will be credited as a plant establishment working day, regardless of whether or not you perform plant establishment work.

Working days whenever you fail to adequately perform plant establishment work will not be credited toward the plant establishment working days.

20-4.01B Definitions

Type 1 plant establishment: Plant establishment period with the number of working days specified for plant establishment beginning after all work has been completed except for plant establishment work and other bid items specified to be performed until Contract acceptance.

Type 2 plant establishment: Plant establishment period with the number of working days specified for plant establishment beginning after all planting work has been completed except for plant establishment work and other bid items specified to be performed until Contract acceptance, provided that the Contract must not be accepted unless the plant establishment work has been satisfactorily performed for at least the number of working days specified for plant establishment.

If maintenance and protection relief is granted for a completed portion of the work under section 5-1.38, Type 2 plant establishment period for the completed portion of the work is the time between

completion of all planting work except for plant establishment work, and the granting of maintenance and protection relief, provided that the relief must not be granted unless the plant establishment work in the completed portion of the work has been satisfactorily performed for at least the number of working days specified for the plant establishment period.

20-4.01C Submittals

20-4.01C(1) General

Submit seasonal watering schedules for use during the plant establishment period within 10 days after the start of the plant establishment period. Remote irrigation control system watering schedule must utilize the remote irrigation control system software program.

Submit updated watering schedules within 5 business days after any changes have been made to the authorized schedules.

Submit a revised watering schedule for each irrigation controller not less than 30 days before completion of the plant establishment period.

20-4.01C(2) Notification

The Engineer will notify you in writing when the plant establishment period begins and will furnish statements regarding the number of working days credited to the plant establishment period after the notification.

Notify the Engineer at least 5 business days before applying each application of fertilizer.

20-4.01D Quality Control and Assurance

Provide training by a qualified person on the use and adjustment of the irrigation controllers installed, 30 days before completion of the plant establishment period.

Perform a final inspection of the plant establishment work in the presence of the Engineer between 20 and 30 days before Contract acceptance.

20-4.02 MATERIALS

20-4.02A General

Reserved

20-4.02B Fertilizers

Fertilizer must comply with section 20-3.01B(5).

20-4.03 CONSTRUCTION

20-4.03A General

Remove trash and debris.

Surplus earth accumulated in roadside clearing and planting areas must be removed.

Trim and mow turf areas as specified for sod in section 20-3.03C(3)(e). Dispose of trimmed and mowed material.

If irregular or uneven areas appear within turf areas, restore to a smooth and even appearance. Reseed turf seed areas.

Remove the tops of foliage protectors if plants become restricted.

Remove foliage protectors, including support stakes, within 30 days before the completion of the plant establishment period.

Keep plant basin walls well formed.

Clean new wye strainers and existing wye strainers that are a part of the new irrigation system annually until the completion of the plant establishment period. The last cleaning must be done within 15 days before the completion of the plant establishment period.

Remove, clean, and reinstall new filters and existing filters that are a part of the new irrigation system annually until the completion of the plant establishment period. The last cleaning must be done within 15 days before the completion of the plant establishment period.

20-4.03B Plant Growth Control

Prune plants planted as part of the Contract as authorized.

Remove plant growth that extends within 2 feet of sidewalks, curbs, dikes, shoulders, walls or fences.

Remove proposed and existing ground cover from within the plant basins, including basin walls, turf areas, and planting areas within edging.

Vines next to walls and fences must be kept staked and tied. Train vines on fences and walls or through cored holes in walls.

20-4.03C Fertilizers

Apply fertilizer to the plants as specified and water into the soil after each application.

Apply fertilizer at the rates shown and spread with a mechanical spreader, whenever possible.

20-4.03D Weed Control

Control weeds under section 20-1.03C(3).

20-4.03E Plant Staking

Replace the plant stakes that are inadequate to support plants with larger stakes.

Remove plant stakes when the Engineer determines they are no longer needed.

20-4.03F Replacement Plants

Replacement plants must comply with section 20-3.01C(4).

Replacement of plants up to and including the 125th plant establishment working day must be with a plant of the same size as originally specified. Plants of a larger container size than those originally specified for replacement plants may be used during the first 125 working days of the plant establishment period.

Replacement of plants after the 125th plant establishment working day must comply with the following size requirements:

Plant size (Original)	Plant size (Replacement)
Pot/liner/plug/seedling	No. 1 container
No. 1 container	No. 5 container
No. 5 container	No. 15 container

Other replacement plants must be the same size as originally specified.

Replacement ground cover plants must comply with the following spacing requirements:

Original spacing (inches)	On center spacing of replacement ground cover plants (inches)		
	Number of completed plant establishment working days		
	1–125	126–190	191–End of plant establishment period
9	9	6	6
12	12	9	6
18	18	12	9
24	24	18	12
36	36	24	18

20-4.03G Watering

Operate the electric automatic irrigation systems in the automatic mode unless authorized.

If any component of the electric automatic irrigation system is operated manually, the day will not be credited as a plant establishment working day unless the manual operation is authorized.

Water plants utilizing the remote irrigation control system software program unless authorized.

Implement the watering schedule at least 10 days before completion of the plant establishment period.

20-4.04 PAYMENT

Not Used

20-5 LANDSCAPE ELEMENTS

20-5.01 GENERAL

20-5.01A General

Section 20-5 includes specifications for constructing and installing landscape elements.

20-5.01B Materials

Not Used

20-5.01C Construction

Earthwork must comply with section 19.

20-5.01D Payment

Not Used

20-5.02 EDGING

20-5.02A General

Section 20-5.02 includes specifications for constructing landscape edging.

20-5.02B Materials

20-5.02B(1) General

Reserved

20-5.02B(2) Header Board Edging

Lumber for header board edging must be one of the following types:

1. Construction grade cedar
2. Pressure-treated Douglas fir
3. Construction heart grade redwood complying with section 57-2.01B(2)

Lumber must be:

1. Rough cut from sound timber.
2. Straight. Sweep must not exceed 1 inch in 6 feet.
3. Free from loose or unsound knots. Knots must be sound, tight, well spaced, and not to exceed 2 inches in size on any face.
4. Free of shakes in excess of 1/3 the thickness of the lumber.
5. Free of splits longer than the thickness of the lumber.
6. Free of other defects that would render the lumber unfit structurally for the purpose intended.

Edging anchors for header board edging must be stakes of the size and shape shown.

20-5.02B(3) Metal Edging

Metal edging must be commercial quality, made of aluminum or steel, and have an L-shaped design. Edging must be a minimum of 4 inches in height. The thickness must be as recommended by the manufacturer for the use intended.

Edging anchors must be from the same manufacturer as the metal edging.

20-5.02B(4) High Density Polyethylene Edging

HDPE edging must be commercial quality and a minimum of 4 inches in height. The thickness must be as recommended by the manufacturer for commercial installation for the use intended.

Edging anchors must be from the same manufacturer as HDPE edging.

20-5.02B(5) Concrete Edging

Concrete for edging must be minor concrete.

20-5.02B(6)–20-5.02B(10) Reserved

20-5.02C Construction

20-5.02C(1) General

Where edging is used to delineate the limits of inert ground cover or mulch areas, install edging before installing inert ground cover or mulch areas.

Saw cut surfaces where (1) asphalt concrete or concrete surfacing must be removed to permit the installation of edging and (2) no joint exists between the surfacing to be removed and the surfacing to remain in place. The surfacing must be cut in a straight line to a minimum depth of 2 inches with a power-driven saw before the surfacing is removed. Spike or stake spacing must comply with the manufacturer's instructions for use and site conditions.

20-5.02C(2) Header Board Edging

Each stake must be driven flush with the top edge of the header board edging and the stake top must be beveled away from the header board at a 45 degree angle. Attach stake to header board with a minimum of two 12-penny hot dipped galvanized nails per stake.

20-5.02C(3) Metal and High Density Polyethylene Edging

Spike or stake spacing must comply with the manufacturer's instructions for use and site conditions.

20-5.02C(4) Concrete Edging

Construct and finish minor concrete edging under section 73-2.

20-5.02C(5)–20-5.02C(9) Reserved

20-5.02D Payment

Edging is measured parallel to the ground surface.

20-5.03 INERT GROUND COVERS AND MULCHES

20-5.03A General

20-5.03A(1) General

20-5.03A(1)(a) Summary

Section 20-5.03 includes specifications for installing inert ground covers and mulches.

20-5.03A(1)(b) Definitions

Reserved

20-5.03A(1)(c) Submittals

Submit:

1. Filter fabric product data including the manufacturer's product sheet and installation instructions
2. Certificate of compliance for filter fabric at least 5 business days before delivery of the material to the job site

20-5.03A(1)(d) Quality Control and Assurance

Reserved

20-5.03A(2) Materials

Soil sterilant must be oxadiazon granular preemergent and must comply with section 20-1.02C.

Filter fabric must be Class A. Staples for filter fabric must comply with section 21-1.02R.

20-5.03A(3) Construction

20-5.03A(3)(a) General

Before performing inert ground cover and mulch work, remove plants and weeds to ground level.

20-5.03A(3)(b) Earthwork

Excavate areas to receive inert ground cover or mulch to the depth shown. Maintain the planned flow lines, slope gradients, and contours of the job site. Grade subgrade to a smooth and uniform surface and compact to not less than 90 percent relative compaction.

20-5.03A(3)(c) Treatment of Soil

After compaction, apply soil sterilant at the maximum label rate. Do not apply soil sterilant more than 12 inches beyond the inert ground cover or mulch limits. The soil sterilant application and inert ground cover or mulch placement must be completed within the same work day.

20-5.03A(3)(d) Filter Fabric

Immediately before placing filter fabric, surfaces to receive filter fabric must be free of loose or extraneous material and sharp objects that may damage the filter fabric during installation.

Align fabric and place in a wrinkle-free manner.

Overlap adjacent rolls of the fabric from 12 to 18 inches. Spread each overlapping roll in the same direction. Fasten fabric with staples flush with the adjacent fabric to prevent movement of fabric by placement of inert ground cover or mulch.

Repair or replace fabric damaged during placement of inert ground cover or mulch with sufficient fabric to comply with overlap requirements.

20-5.03A(4) Payment

Not Used

20-5.03B Rock Blanket

20-5.03B(1) General

20-5.03B(1)(a) Summary

Section 20-5.03B includes specifications for placing rock blanket.

20-5.03B(1)(b) Definitions

Reserved

20-5.03B(1)(c) Submittals

Submit a 1 sq yd sample of the various rock sizes.

20-5.03B(1)(d) Quality Control and Assurance

Reserved

20-5.03B(2) Materials

20-5.03B(2)(a) General

Do not use filter fabric.

20-5.03B(2)(b) Concrete

Concrete must be minor concrete.

20-5.03B(2)(c) Rock

Rock must be clean, smooth, and obtained from a single source and must comply with the following grading requirements:

Grading Requirements

Screen size (inches)	Percentage passing
8	100
6	50-85
4	0-50

20-5.03B(2)(d) Mortar

Mortar must comply with section 51-1.02F.

20-5.03B(3) Construction

Place concrete as shown.

Rock must be placed while concrete is still plastic. Remove concrete adhering to the exposed surfaces of the rock.

Loose rocks or rocks with a gap greater than 3/8 inch must be reset by an authorized method. The rock gap is measured from the edge of the rock to the surrounding concrete bedding.

Place mortar as shown.

20-5.03B(4) Payment

Rock blanket is measured parallel to the rock blanket surface.

20-5.03C Gravel Mulch

20-5.03C(1) General

20-5.03C(1)(a) Summary

Section 20-5.03C includes specifications for placing gravel mulch.

20-5.03C(1)(b) Definitions

Reserved

20-5.03C(1)(c) Submittals

Submit a 5-lb sample of the gravel mulch.

20-5.03C(1)(d) Quality Control and Assurance

Reserved

20-5.03C(2) Materials

Gravel mulch must be:

1. Uniform gray color
2. From a single source only
3. Crushed rock that complies with the following grading requirements:

Grading Requirements

Sieve size	Percent passing
1-1/4 inch	100
3/4 inch	60-80
1/2 inch	45-65
No. 40	5-20

20-5.03C(3) Construction

Place gravel and compact by rolling.

The finished gravel mulch surface must be smooth and uniform, maintaining original flow lines, slope gradients, and contours of the job site.

20-5.03C(4) Payment

Gravel mulch is measured parallel to the gravel mulch surface.

20-5.03D Decomposed Granite

20-5.03D(1) General

20-5.03D(1)(a) Summary

Section 20-5.03D includes specifications for placing decomposed granite.

20-5.03D(1)(b) Definitions

Reserved

20-5.03D(1)(c) Submittals

Five business days before delivery of the materials to the job site, submit:

1. Solidifying emulsion product data including the manufacturers' product sheets and installation instructions
2. Certificate of compliance for solidifying emulsion
3. 5-lb sample of the decomposed granite

20-5.03D(1)(d) Quality Control and Assurance

Test plot must be:

1. Constructed at an authorized location
2. At least 3 by 12 feet
3. Constructed using the materials, equipment, and methods to be used in the work
4. Authorized before starting work

Notify the Engineer not less than 7 days before constructing the test plot.

The Engineer uses the authorized test plot to determine acceptability of the work.

If ordered, prepare additional test plots. Additional test plots are change order work.

If the test plot is not incorporated into the work, the Engineer may order you to remove it.

20-5.03D(2) Materials

20-5.03D(2)(a) General

Decomposed granite must be:

1. Uniform gray or tan color
2. From one source only
3. Crushed granite rock that complies with grading requirements shown in the following table:

Grading Requirements

Sieve size	Percent passing
3/8 inch	100
No. 4	95–100
No. 8	75–80
No. 16	55–65
No. 30	40–50
No. 50	25–35
No. 100	20–25
No. 200	5–15

Note:

Grading based upon AASHTO T11-82 and T27-82

20-5.03D(2)(b) Solidifying Emulsion

Solidifying emulsion must be either a water-based polymer or nontoxic organic powdered binder specifically manufactured to harden decomposed granite. The solidifying emulsion must not alter the decomposed granite color.

20-5.03D(3) Construction

Do not place decomposed granite during rainy conditions.

Mix solidifying emulsion thoroughly and uniformly throughout the decomposed granite and under the manufacturer's instructions. Mix the material in the field using portable mixing equipment, or delivered in mixer trucks from a local ready-mixed plant.

Place decomposed granite uniformly in layers no more than 1-1/2 inch thick. Compact each layer of decomposed granite to a relative compaction of not less than 90 percent. Begin compaction within 6 to 48 hours of placement.

If the material was mixed in the field, apply an application of solidifying emulsion after compaction as recommended by the manufacturer. Prevent runoff or overspray of solidifying emulsion onto adjacent paved or planting areas.

The finished decomposed granite surface must be smooth and uniform, compacted to a relative compaction of not less than 90 percent, maintaining original flow lines, slope gradients, and contours of the job site.

20-5.03D(4) Payment

Not Used

20-5.03E Wood Mulch

20-5.03E(1) General

20-5.03E(1)(a) Summary

Section 20-5.03E includes specifications for placing wood mulch.

20-5.03E(1)(b) Definitions

Reserved

20-5.03E(1)(c) Submittals

Submit a certificate of compliance for mulch.

Submit a 2 cu ft mulch sample with the mulch source listed on the bag and obtain approval before delivery of mulch to the job site.

20-5.03E(1)(d) Quality Control and Assurance

Reserved

20-5.03E(2) Materials

20-5.03E(2)(a) General

Mulch must not contain more than 0.1 percent of deleterious materials such as rocks, glass, plastics, metals, clods, weeds, weed seeds, coarse objects, sticks larger than the specified particle size, salts, paint, petroleum products, pesticides or other chemical residues harmful to plant or animal life.

Do not use filter fabric.

20-5.03E(2)(b) Tree Bark Mulch

Tree bark mulch must be derived from cedar, Douglas fir, or redwood species.

Tree bark mulch must be ground so that at least 95 percent of the material by volume is less than 2 inches and no more than 30 percent by volume is less than 1 inch.

20-5.03E(2)(c) Wood Chip Mulch

Wood chip mulch must:

1. Be derived from clean wood
2. Not contain leaves or small twigs
3. Contain at least 95 percent wood chips by volume with average thickness of 1/16 to 3/8 inch in any direction and 1/2 to 3 inches in length

20-5.03E(2)(d) Shredded Bark Mulch

Shredded bark mulch must:

1. Be derived from trees
2. Be a blend of loose, long, thin wood, or bark pieces
3. Contain at least 95 percent wood strands by volume with average thickness of 1/8 to 1-1/2 inches in any direction and 2 to 8 inches in length

20-5.03E(2)(e) Tree Trimming Mulch

Tree trimming mulch must:

1. Be derived from chipped trees and may contain leaves and small twigs.
2. Contain at least 95 percent material by volume less than 3 inches and no more than 30 percent by volume less than 1 inch

20-5.03E(2)(f)–20-5.03E(2)(j) Reserved

20-5.03E(3) Construction

Spread mulch placed in areas outside of plant basins to a uniform thickness as shown.

Mulch must be placed at the rate described and placed in the plant basins or spread in areas as shown after the plants have been planted. Mulch placed in plant basins must not come in contact with the plant crown and stem.

Spread mulch from the outside edge of the proposed plant basin or plant without basin to the adjacent edges of shoulders, paving, retaining walls, dikes, edging, curbs, sidewalks, walls, fences, and existing plantings. If the proposed plant or plant without basin is 12 feet or more from the adjacent edges of shoulders, paving, retaining walls, dikes, edging, curbs, sidewalks, walls, fences, and existing plantings, spread the mulch 6 feet beyond the outside edge of the proposed plant basin or plant without basin.

Do not place mulch within 4 feet of:

1. Flow line of earthen drainage ditches
2. Edge of paved ditches
3. Drainage flow lines

20-5.03E(4) Payment

Mulch is measured in the vehicle at the point of delivery.

20-5.03F–20-5.03J Reserved

20-5.04 RESERVED

Reserved

20-5.05 SITE FURNISHINGS

20-5.05A General

Section 20-5.05 includes specifications for installing site furnishings.

20-5.05B–20-5.05Z Reserved

20-5.06–20-5.10 RESERVED

AA

21 EROSION CONTROL

07-19-13

Replace ", bonded fiber matrix, and polymer-stabilized fiber matrix" in the 1st paragraph of section 21-1.01B with:

and bonded fiber matrix

04-20-12

Delete the last paragraph of section 21-1.02E.

04-20-12

Replace section 21-1.02F(2) with:

21-1.02F(2) Reserved

04-20-12

Replace "20-7.02D(1)" in the 1st paragraph of section 21-1.02H with:

20-3.01B(4)

07-19-13

Replace section 21-1.02J with:

21-1.02J Reserved

04-20-12

Replace the row for organic matter content in the table in the 4th paragraph of section 21-1.02M with:

01-18-13

Organic matter content	TMECC 05.07-A Loss-on-ignition organic matter method (LOI) % dry weight basis	30–100
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Replace section 28-2 with:

07-19-13

28-2 LEAN CONCRETE BASE

28-2.01 GENERAL

28-2.01A Summary

Section 28-2 includes specifications for constructing lean concrete base (LCB).

28-2.01B Definitions

coarse aggregate: Aggregate retained on a no. 4 sieve.

fine aggregate: Aggregate passing a no. 4 sieve.

28-2.01C Submittals

28-2.01C(1) General

At least 25 days before field qualification, submit the name of your proposed testing laboratory.

At least 10 days before field qualification, submit:

1. Aggregate qualification test results
2. Proposed aggregate gradation
3. Mix design, including:
 - 3.1. Proportions
 - 3.2. Types and amounts of chemical admixtures
4. Optional notice stating intent to produce LCB qualifying for a transverse contraction joint waiver under section 28-2.03D

Submittals for cementitious material must comply with section 90-1.01C(3).

Submit QC test results within 24 hours of test completion.

28-2.01C(2) Field Qualification

11-15-13

For each field qualification for each mix design, manufacture 12 specimens under ASTM C 31 and submit six of the specimens from 24 to 72 hours after manufacture. Use one batch for all 12 specimens.

07-19-13

Submit field qualification data and test reports including:

1. Mixing date
2. Mixing equipment and procedures used
3. Batch volume in cu yd, the minimum is 5 cu yd
4. Type and source of ingredients used
5. Age and strength from compression strength results

Field qualification test reports must be signed by the official in responsible charge of the laboratory performing the tests.

28-2.01D Quality Control and Assurance

28-2.01D(1) General

Stop LCB activities and immediately notify the Engineer whenever:

1. Any quality control or acceptance test result does not comply with the specifications
2. Visual inspection shows noncompliant LCB

If LCB activities are stopped, before resuming activities:

1. Inform the Engineer of the adjustments you will make
2. Remedy or replace the noncompliant LCB

3. Obtain authorization

Molds for compressive strength testing under ASTM C 31 or ASTM C 192 must be 6 by 12 inches.

Quality control and assurance for cementitious materials and admixtures must comply with section 90-1.01D(1)

28-2.01D(2) Aggregate Qualification Testing

Qualify the aggregate for each proposed aggregate source and gradation. Qualification tests include (1) sand equivalent and (2) average 7-day compressive strength under ASTM C 39 on 3 specimens manufactured under ASTM C 192. The cement content for this test must be 300 lb/cu yd, and the 7-day average compressive strength must be at least 610 psi. Cement must be Type II portland cement under section 90-1.02B(2).

LCB must have from 3 to 4 percent air content during aggregate qualification testing.

28-2.01D(3) Field Qualification Testing

Before placing LCB, you must perform field qualification testing and obtain authorization for each mix design. Retest and obtain authorization for changes to authorized mixed designs.

Proposed mix designs must be field qualified before you place the LCB represented by those mix designs. Use an American Concrete Institute (ACI) certified "Concrete Laboratory Technician, Grade I" to perform field qualification tests and calculations.

Notify the Engineer at least 5 days before field qualification. Perform field qualification within the job site or a location authorized by the Engineer.

Field qualification testing includes compressive strength, air content, and penetration or slump in compliance with the table titled "Quality Control Requirements."

Field qualification testing for compressive strength must comply with the following:

1. Manufacture 12 cylinders under ASTM C 31 from a single batch
2. Perform 3 tests; each test consists of determining the average compressive strength of 2 cylinders at 7 days under ASTM C 39
3. The average compressive strength for each test must be at least 530 psi

If you submitted a notice to produce LCB qualifying for a transverse contraction joint waiver, manufacture additional specimens and test LCB for compressive strength at 3 days. Prepare compressive strength cylinders under ASTM C 31 at the same time using the same material and procedures as the 7-day compressive strength cylinders except do not submit 6 additional test cylinders. The average 3-day compressive strength for each test must be not more than 500 psi.

28-2.01D(4) Quality Control Testing

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.

Perform quality control sampling, testing, and inspection throughout LCB production and placement. LCB must comply with the requirements for the quality characteristics shown in the following table:

Quality Control Requirements

Quality characteristic	Test method	Minimum sampling and testing frequency	Requirement
Sand equivalent (min)	ASTM D 2419	1 per 500 cubic yards but at least 1 per day of production	18
Aggregate gradation	ASTM C 136		Note a
Air content (max, percent) ^b	ASTM C 231		4
Penetration (inches)	ASTM C 360		0 to 1-1/2 nominal ^{c, d}
Slump (inches)	ASTM C 143		0-3 nominal ^{c, d}
Compressive strength (min, psi at 7 days)	ASTM C 39 ^e		530
Compressive strength (max, psi at 3 days) ^f	ASTM C 39 ^e		500

^a Comply with the table titled "Aggregate Grading" in section 28-2.02C.

^b If no single test in the first 5 air content tests exceeds 1-1/2 percent, no further air content tests are required.

^c Maximum penetration must not exceed 2 inches and maximum slump must not exceed 4 inches

^d Test for either penetration or slump

^e Prepare cylinders under ASTM C 31

^f Only applicable if you (1) submitted a notice stating intent to produce LCB qualifying for a transverse contraction joint waiver and (2) successfully field qualified the LCB for 3-day compressive strength. Make cylinders at the same time using the same material and procedures as QC testing for 7-day compressive strength.

28-2.01D(5) Acceptance Criteria

For acceptance, properties of LCB must comply with values shown in the following table:

Acceptance Criteria Testing

Property	Test method	Value
Compressive strength (min, psi at 7 days)	ASTM C 39 ^a	530 ^b

^a Cylinders prepared under ASTM C 31

^b A compressive strength test represents up to (1) 1,000 cu yd or (2) 1 day's production if less than 1,000 cu yd.

28-2.02 MATERIALS

28-2.02A General

Water must comply with section 90-1.02D.

The air content in LCB must not exceed 4 percent. If the aggregate used for LCB is produced from processed reclaimed asphalt concrete or other material that may cause the air content to exceed 4 percent, reduce the air content with an admixture.

A water-reducing chemical admixture may be used. Water-reducing chemical admixture must comply with ASTM C 494, Type A or Type F.

Air-entraining admixtures must comply with section 90-1.02E.

28-2.02B Cementitious Material

Portland cement must comply with section 90-1.02B. Portland cement content must not exceed 300 lb/cu yd.

SCM must comply with section 90-1.02B except the equations for SCM content under 90-1.02B(3) do not apply.

For aggregate qualification testing, use Type II portland cement under section 90-1.02B(2) without SCM.

28-2.02C Aggregate

Aggregate must be clean and free from decomposed material, organic material, and other deleterious substances. Aggregate samples must not be treated with lime, cement, or chemicals before testing for sand equivalent.

Use either 1-1/2 inch or 1 inch grading. Do not change your selected aggregate grading without authorization.

When tested under ASTM C 136, the percentage composition by weight of the aggregate must comply with the grading requirements for the sieve sizes shown in the following table:

Sieve sizes	Aggregate Grading			
	Percentage passing			
	1-1/2" maximum		1" maximum	
	Operating range	Contract compliance	Operating range	Contract compliance
2"	100	100	--	--
1-1/2"	90-100	87-100	100	100
1"	--	--	90-100	87-100
3/4"	50-85	45-90	50-100	45-100
3/8"	40-75	35-80	40-75	35-80
No. 4	25-60	20-65	35-60	30-65
No. 30	10-30	6-34	10-30	6-34
No. 200	0-12	0-15	0-12	0-15

Aggregate must comply with the quality requirements shown in the following table:

Aggregate Quality			
Property	Test Method	Operating range	Contract compliance
Sand equivalent (min)	ASTM D 2419	21	18
Compressive strength (min, psi at 7 days)	ASTM C 192 ASTM C 39	--	610 at 300 lb/cu yd cement content

Note: Cement must be Type II portland cement under section 90-1.02B(2).

If the aggregate grading or the sand equivalent test results, or both comply with contract compliance requirements but not operating range requirements, you may continue placing LCB for the remainder of the work day. Do not place additional LCB until you demonstrate the LCB to be placed complies with the operating range requirements.

28-2.03 CONSTRUCTION

28-2.03A General

Do not allow traffic or equipment on the LCB for at least 72 hours after the 1st application of the curing compound and completion of contraction joints. Limit traffic and equipment on the LCB to that is required for placing additional layers of LCB or paving.

28-2.03B Subgrade

Immediately before spreading LCB, the subgrade must:

1. Comply with the specified compaction and elevation tolerance for the material involved
2. Be free from loose or extraneous material
3. Be uniformly moist

Areas of subgrade lower than the grade established by the Engineer must be filled with LCB. The Department does not pay for filling low areas of subgrade.

28-2.03C Proportioning, Mixing, and Transporting

Proportion LCB under section 90-1.02F except aggregate does not have to be separated into sizes.

Mix and transport LCB under section 90-1.02G except the 5th and 7th paragraphs in section 90-1.02G(6) do not apply.

28-2.03D Placing

Place LCB under section 40-1.03H(1) except the 3rd paragraph does not apply.

Unless otherwise described, construct LCB in minimum widths of 12 feet separated by construction joints. For LCB constructed monolithically in widths greater than 26 feet, construct a longitudinal contraction joint offset no more than 3 feet from the centerline of the width being constructed.

Contraction joints must comply with section 40-1.03D(3).

Construct transverse contraction joints in intervals that result in LCB areas where the lengths and widths are within 20 percent of each other. Measure the widths from any longitudinal construction or longitudinal contraction joints.

The Engineer waives the requirement for transverse contraction joints if you:

1. Submitted a notice under 28-2.01C(1)
2. Successfully field qualified LCB for 3-day compressive strength testing
3. Submit QC test results for 3-day compressive strength under section 28-2.01D(4).

If concrete pavement will be placed on LCB, construct longitudinal construction and longitudinal contraction joints in the LCB. Provide at least 1 foot horizontal clearance from planned longitudinal construction and longitudinal contraction joints in the concrete pavement.

Do not mix or place LCB when the atmospheric temperature is below 35 degrees F. Do not place LCB on frozen ground.

28-2.03E Finishing

Place LCB under section 40-1.03H(4) or under section 40-1.03H(5) except where there are confined work areas and when authorized:

1. Spread and shape LCB using suitable powered finishing machines and supplement with hand work as necessary
2. Consolidate LCB using high-frequency internal vibrators within 15 minutes after LCB is deposited on the subgrade
3. Vibrate with care such that adequate consolidation occurs across the full paving width and do not use vibrators for extensive weight shifting of the LCB

For LCB to be paved with HMA, before curing operation texture the LCB finished surface by dragging a broom, burlap, or a spring steel tine device. If using a spring steel tine device, the device must produce a scored surface with scores parallel or transverse to the pavement centerline. Texture at a time and in a manner that produces the coarsest texture for the method used.

For LCB to be paved with HMA, the finished surface must not vary more than 0.05 foot from the grade established by the Engineer.

Do not texture LCB that will be covered with concrete pavement. Before applying curing compound, finish LCB to a smooth surface free from mortar ridges and other projections.

For LCB to be paved with concrete pavement, the finished surface must not be above the grade, or more than 0.05 foot below the grade established by the Engineer.

The finished surface must be free from porous areas.

28-2.03F Curing

After finishing LCB, cure LCB with pigmented curing compound under section 90-1.03B(3) and 40-1.03K except for LCB to be paved with concrete pavement, comply with section 36-2. Apply curing compound to the area to be paved with concrete pavement:

1. In 2 separate applications
2. Before the atmospheric temperature falls below 40 degrees F

37 BITUMINOUS SEALS

03-21-14

Replace section 37-1.01 with:

01-18-13

37-1.01 GENERAL

37-1.01A Summary

Section 37-1 includes general specifications for applying bituminous seals.

37-1.01B Definitions

Reserved

37-1.01C Submittals

Reserved

37-1.01D Quality Control and Assurance

37-1.01D(1) General

Reserved

37-1.01D(2) Prepaving Conference

For seal coats and micro-surfacing, schedule a prepaving conference at a mutually agreed upon time and place to meet with the Engineer.

Prepaving conference attendees must sign an attendance sheet provided by the Engineer. The prepaving conference must be attended by your:

1. Project superintendent
2. Paving construction foreman
3. Traffic control foreman

Be prepared to discuss:

1. Quality control
2. Acceptance testing
3. Placement
4. Training on placement methods
5. Checklist of items for proper placement
6. Unique issues specific to the project, including:
 - 6.1. Weather
 - 6.2. Alignment and geometrics
 - 6.3. Traffic control issues
 - 6.4. Haul distances
 - 6.5. Presence and absence of shaded areas
 - 6.6. Any other local issues

37-1.02 MATERIALS

Not Used

37-1.03 CONSTRUCTION

Not Used

37-1.04 PAYMENT

Not Used

Replace section 37-2 with:

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37-2 SEAL COATS

37-2.01 GENERAL

37-2.01A General

37-2.01A(1) Summary

Section 37-2 includes specifications for applying seal coats.

37-2.01A(2) Definitions

Reserved

37-2.01A(3) Submittals

Reserved

37-2.01A(4) Quality Control and Assurance

The following personnel must attend the prepping conference:

1. Aggregate suppliers
2. Chip spreader operators
3. Emulsion and binder distributor
4. Coated chips producer if coated chips are used

37-2.01B Materials

Screenings must be broken stone, crushed gravel, or both. At least 90 percent of screenings by weight must be crushed particles as determined under California Test 205.

Screenings for seal coats must have the properties specified in the following table:

Seal Coat Screenings

Properties	Test method	Specification
Los Angeles Rattler, %, max Loss at 100 revolutions. Loss at 500 revolutions.	California Test 211	10 40
Film stripping, %, max	California Test 302	25

37-2.01C Construction

37-2.01C(1) General

Wherever final sweeping or brooming of the seal coat surface is complete, place permanent traffic stripes and pavement markings within 10 days.

If you fail to place the permanent traffic stripes and pavement markings within the specified time, the Department withholds 50 percent of the estimated value of the seal coat work completed that has not received permanent traffic stripes and pavement markings.

37-2.01C(2) Equipment

Equipment for seal coats must include and comply with the following:

1. Screenings haul trucks. Haul trucks must have:
 - 1.1. Tailgates that discharge screenings
 - 1.2. Devices to lock onto the rear screenings spreader hitch
 - 1.3. Dump beds that will not push down on the spreader when fully raised
 - 1.4. Dump beds that will not spill screenings on the roadway when transferred to the spreader hopper
 - 1.5. Tarpaulins to cover precoated screenings when haul distance exceeds 30 minutes or ambient temperature is less than 65 degrees F
2. Self-propelled screenings spreader. The spreader must have:
 - 2.1. Screenings hopper in the rear

- 2.2. Belt conveyors that carry the screenings to the front
- 2.3. Spreading hopper capable of providing a uniform screening spread rate over the entire width of the traffic lane in 1 application.
3. Self-propelled power brooms. Do not use gutter brooms or steel-tined brooms. Brooms must be capable of removing loose screenings adjacent to barriers that prevent screenings from being swept off the roadway, including curbs, gutters, dikes, berms, and railings.
4. Pneumatic-tired rollers. Pneumatic-tired rollers must be an oscillating type at least 4 feet wide. Each roller must be self-propelled and reversible. Pneumatic tires must be of equal size, diameter, type, and ply. The roller must carry at least 3,000 lb of load on each wheel and each tire must have an air pressure of 100 ± 5 psi.

37-2.01C(3) Surface Preparation

Before applying seal coat, cover 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 by tape or adhesive to the facility being covered. Reference the covered facilities with a sufficient number of control points to relocate the facilities after the application of the seal coat.

After completion of the seal coat operation, remove covers from the facilities.

Immediately before applying seal coat, clean the surface to receive seal coat by removing extraneous material and drying. Cleaning the existing pavement includes the use of brooms.

37-2.01C(4) Applying Emulsion and Asphalt Binder

Prevent spray on existing pavement not intended for seal coat or on previously applied seal coat using a material such as building paper. Remove the material after use.

Align longitudinal joints between seal coat applications with designated traffic lanes.

For emulsion, overlap longitudinal joints by not more than 4 inches. You may overlap longitudinal joints up to 8 inches if authorized.

For areas not accessible to a truck distributor bar, apply the emulsion with a squeegee or other authorized means. For asphalt binder, hand spray nonaccessible areas. You may overlap the emulsion or asphalt binder applications before the application of screenings at longitudinal joints.

Do not apply the emulsion or asphalt binder unless there are sufficient screenings at the job site to cover the emulsion or asphalt binder.

Discontinue application of emulsion or asphalt binder early enough to comply with lane closure specifications and darkness. Apply to 1 lane at a time and cover the lane entirely in 1 operation.

37-2.01C(5) Spreading Screenings

Prevent vehicles from driving on asphaltic emulsion or asphalt binder before spreading screenings.

Spread screenings at a uniform rate over the full lane width in 1 application.

Broom excess screenings at joints before spreading adjacent screenings.

Operate the spreader at speeds slow enough to prevent screenings from rolling over after dropping.

If the spreader is not moving, screenings must not drop. If you stop spreading and screenings drop, remove the excess screenings before resuming activities.

37-2.01C(6) Finishing

Remove piles, ridges, or unevenly distributed screenings. Repair permanent ridges, bumps, or depressions in the finished surface. Spread additional screenings and roll if screenings are picked up by rollers or vehicles.

Seal coat joints between adjacent applications of seal coat must be smooth, straight, uniform, and completely covered. Longitudinal joints must be at lane lines and not overlap by more than 4 inches. Blend the adjacent applications by brooming.

A coverage is the number of passes a roller needs to cover the width. A pass is 1 roller movement parallel to the seal coat application in either direction. Overlapping passes are part of the coverage being made and are not part of a subsequent coverage. Do not start a coverage until completing the previous coverage.

Before opening to traffic, finish seal coat in the following sequence:

1. Perform initial rolling consisting of 1 coverage with a pneumatic-tired roller
2. Perform final rolling consisting of 3 coverages with a pneumatic-tired roller
3. Broom excess screenings from the roadway and adjacent abutting areas
4. Apply flush coat if specified

The Engineer may order salvaging of excess screenings.

Dispose of excess screenings the Engineer determines are not salvageable. Dispose of screenings in any of the following ways or locations:

1. Under section 14-10
2. On embankment slopes
3. In authorized areas

Salvaging and stockpiling excess screenings is change order work.

37-2.01C(7) Seal Coat Maintenance

Seals coat surfaces must be maintained for 4 consecutive days from the day screenings are applied. Maintenance must include brooming to maintain a surface free of loose screenings, to distribute screenings over the surface so as to absorb any free asphaltic material, to cover any areas deficient in cover coat material, and to prevent formation of corrugations.

After 4 consecutive days, excess screenings must be removed from the paved areas. Brooming must not displace screenings set in asphaltic material.

The exact time of brooming will be determined by the Engineer. As a minimum, brooming will be required at the following times:

1. On 2-lane 2-way roadways, from 2 to 4 hours after traffic, controlled with pilot cars, has been routed on the seal coat
2. On multilane roadways, from 2 to 4 hours after screenings have been placed
3. In addition to previous brooming, immediately before opening any lane to public traffic, not controlled with pilot cars
4. On the morning following the application of screenings on any lane that has been open to public traffic not controlled with pilot cars and before starting any other activities

For 2-lane 2-way roadways under 1-way traffic control, upon completion of secondary rolling, public traffic must be controlled with pilot cars and routed over the new seal coat for a period of 2 to 4 hours. The Engineer will determine the exact period of time.

Schedule the operations so that seal coat is placed on both lanes of the traveled way each work shift and so that 1-way traffic control is discontinued 1 hour before darkness. At the end of the work shift, the end of the seal coat on both lanes must generally match.

On multilane roadways, initial brooming must begin after the screenings have been in place for a period of 2 to 4 hours. If the initial brooming is not completed during the work shift in which the screenings were placed, the initial brooming must be completed at the beginning of the next work shift.

Public traffic must be controlled with pilot cars and be routed on the new seal coat surface of the lane for a minimum of 2 hours after completion of the initial brooming and before opening the lane to traffic not controlled with pilot cars. When traffic is controlled with pilot cars, a maximum of 1 lane in the direction of travel must be open to public traffic. Once traffic controlled with pilot cars is routed over the seal coat at a particular location, continuous control must be maintained at that location until the seal coat placement and brooming on adjacent lanes to receive seal coat is completed.

37-2.01D Payment

If there is no bid item for a traffic control system, furnishing and using a pilot car is included in the various items of the work involved in applying the seal coat.

If test results for the screenings grading do not comply with specifications, you may remove the seal coat represented by these tests or request that it remain in place with a payment deduction. The deduction is \$1.75 per ton for the screenings represented by the test results.

37-2.02 FOG SEAL

37-2.02A General

37-2.02A(1) Summary

Fog seal coat includes applying a slow-setting asphaltic emulsion.

37-2.02A(2) Definitions

Reserved

37-2.02A(3) Submittals

Submit a 1/2-gallon sample of the asphaltic emulsion in a plastic container. Take the sample from the distributor truck spray bar at mid-load.

37-2.02A(4) Quality Control and Assurance

Reserved

37-2.02B Material

The Engineer selects the grade of slow-setting asphaltic emulsion to be used.

If additional water is added to the asphaltic emulsion, the resultant mixture must not be more than 1 part asphaltic emulsion to 1 part water. The Engineer determines the exact amount of additional water.

37-2.02C Construction

Apply asphaltic emulsion for fog seal coat at a residual asphalt rate from 0.02 to 0.06 gal/sq yd. The Engineer determines the exact rate.

Apply fog seal coat when the ambient air temperature is above 40 degrees F.

Sprinkle water on fog seal coat that becomes tacky in an amount determined by the Engineer.

If fog seal coat and seal coat with screenings are specified on the same project, apply fog seal coat at least 4 days before applying the adjoining seal coat with screenings. The joint between the seal coats must be neat and uniform.

37-2.02D Payment

The Department does not adjust the unit price for an increase or decrease in the asphaltic emulsion (fog seal coat) quantity.

37-2.03 FLUSH COATS

37-2.03A General

Flush coat includes applying a fog seal coat to the surface, followed by sand.

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37-2.03B Material

The Engineer selects the grade of slow-setting or quick-setting asphaltic emulsion to be used.

Sand for flush coat must comply with the material specifications for fine aggregate grading in section 90-1.02C(3). Sand must not include organic material or clay.

37-2.03C Construction

Apply asphaltic emulsion for flush coat at a residual asphalt rate from 0.02 to 0.06 gal/sq yd. The Engineer determines the exact rate.

During flush coat activities, close adjacent lanes to traffic. Do not track asphaltic emulsion on existing pavement surfaces.

Apply sand immediately after the asphaltic emulsion application.

Spread sand with a self-propelled screenings spreader equipped with a mechanical device that spreads sand at a uniform rate over the full width of a traffic lane in a single application. Spread sand at a rate from 2 to 6 lb/sq yd. The Engineer determines the exact rate.

37-2.03D Payment

The Department does not adjust the unit price for an increase or decrease in the sand cover for the flush coat quantity.

37-2.04 ASPHALTIC EMULSION SEAL COAT

37-2.04A General

37-2.04A(1) General

37-2.04A(1)(a) Summary

Section 37-2.04 includes specifications for applying asphaltic emulsion seal coat. Asphaltic emulsion seal coat includes applying asphaltic emulsion, followed by screenings, and then a flush coat.

Asphaltic emulsion seal coat includes one or more of the following types:

1. Nonpolymer asphaltic emulsion seal coat
2. Polymer asphaltic emulsion seal coat

A double asphaltic emulsion seal coat is the application of asphaltic emulsion, followed by screenings applied twice in sequence.

37-2.04A(1)(b) Definitions

Reserved

37-2.04A(1)(c) Submittals

At least 10 days before starting asphaltic emulsion seal coat application, submit the name of an authorized laboratory that will be performing asphaltic emulsion QC testing.

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Submit a sample of asphaltic emulsion in a 1/2-gallon plastic container to the Engineer and to the authorized laboratory. Each sample must be submitted in an insulated shipping container within 24 hours of sampling.

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Within 7 days after taking samples, submit the authorized laboratory's test results for asphaltic emulsion.

37-2.04A(1)(d) Quality Control and Assurance

Samples for the screenings grading and cleanness value must be taken from the spreader conveyor belt.

03-21-14

Within 3 business days of sampling, the authorized laboratory must test the asphaltic emulsion for:

1. Viscosity under AASHTO T 59
2. Sieve test under AASHTO T 59
3. Demulsibility under AASHTO T 59
4. Torsional recovery under California Test 332 for polymer asphaltic emulsion
5. Elastic recovery under AASHTO T 301 for polymer asphaltic emulsion

Circulate asphaltic emulsion in the distributor truck before sampling. Take samples from the distributor truck at mid load or from a sampling tap or thief. Before taking samples, draw and dispose of 1 gallon. In the presence of the Engineer take two 1/2-gallon samples every 55 tons or at least 1 day's production.

37-2.04A(2) Materials

Not Used

37-2.04A(3) Construction

The Engineer determines the exact application rate.

At the time of application, the temperature of the asphaltic emulsion must be from 130 to 180 degrees F.

When tested under California Test 339, the application rate for asphaltic emulsion must not vary from the average by more than:

1. 15 percent in the transverse direction
2. 10 percent in the longitudinal direction

37-2.04A(4) Payment

Not Used

37-2.04B Nonpolymer Asphaltic Emulsion Seal Coat**37-2.04B(1) General****37-2.04B(1)(a) Summary**

Section 37-2.04B includes specifications for applying a nonpolymer asphaltic emulsion seal coat.

37-2.04B(1)(b) Definitions

Reserved

37-2.04B(1)(c) Submittals

Reserved

37-2.04B(1)(d) Quality Control and Assurance

For nonpolymer asphaltic emulsion seal coat, if a test result for the screenings cleanness value is from 75 to 80, you may request that the asphaltic emulsion seal coat represented by the test remain in place. A payment deduction is made as specified in section 37-2.04D. If the screenings cleanness value is less than 75, remove the asphaltic emulsion seal coat.

37-2.04B(2) Materials

Screenings for nonpolymer asphaltic emulsion seal coat must have the gradation as determined under California Test 202 in the following table.

**Nonpolymer Asphaltic Emulsion Seal Coat Screenings
Gradation**

Sieve sizes	Percentage passing			
	Coarse 1/2" max	Medium 3/8" max	Medium fine 5/16" max	Fine 1/4" max
3/4"	100	--	--	--
1/2"	95-100	100	--	--
3/8"	50-80	90-100	100	100
No. 4	0-15	5-30	30-60	60-85
No. 8	0-5	0-10	0-15	0-25
No. 16	--	0-5	0-5	0-5
No. 30	--	--	0-3	0-3
No. 200	0-2	0-2	0-2	0-2

The cleanness value determined under California Test 227 must be 80 or greater.

03-21-14

37-2.04B(3) Construction

Asphaltic emulsion must be applied within the application rate ranges shown in the following table:

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Asphaltic Emulsion Application Rates

Screenings	Application rate range(gallons per square yard)
Fine	0.15–0.30
Medium fine	0.25–0.35
Medium	0.25–0.40
Coarse	0.30–0.40

Apply asphaltic emulsion when the ambient air temperature is from 65 to 110 degrees F and the pavement surface temperature is at least 80 degrees F.

Do not apply asphaltic emulsion when weather forecasts predict the ambient air temperature will fall below 39 degrees F within 24 hours after application.

For double asphaltic emulsion seal coat, the asphaltic emulsion must be applied within the application rates shown in the following table:

Asphaltic Emulsion Application Rates

Screenings	Application rate range (gal/sq yd)
Double	
1st application	0.20–0.35
2nd application	0.20–0.30

You may stockpile screenings for asphaltic emulsion seal coat if you prevent contamination. Screenings must have damp surfaces at spreading. If water visibly separates from the screenings, do not spread. You may redampen them in the delivery vehicle.

Spread screenings before the asphaltic emulsion sets or breaks.

Spread screenings within 10 percent of the rate determined by the Engineer. Screenings must have a spread rate within the ranges shown in the following table:

Screening Spread Rates

Seal coat type	Range (lb/sq yd)
Fine	12–20
Medium fine	16–25
Medium	20–30
Coarse	23–30

Do not spread screenings more than 2,500 feet ahead of the completed initial rolling.

For double asphaltic emulsion seal coat, screenings must have a spread rate within the ranges shown in the following table:

Screening Spread Rates

Seal coat type	Range (lb/sq yd)
Double	
1st application	23–30
2nd application	12–20

Remove excess screenings on the 1st application before the 2nd application of asphaltic emulsion.

37-2.04B(4) Payment

If asphaltic emulsion seal coat with screenings does not comply with the cleanness value specifications, you may request that the seal coat remain in place with a pay deduction corresponding to the cleanness value shown in the following table:

Asphaltic Emulsion Seal Coat Cleanness Value Deductions

Cleanness value	Deduction
80 or over	None
79	\$2.00 /ton
77-78	\$4.00 /ton
75-76	\$6.00 /ton

37-2.04C Polymer Asphaltic Emulsion Seal Coat

37-2.04C(1) General

37-2.04C(1)(a) Summary

Section 37-2.04C includes specifications for applying a polymer asphaltic emulsion seal coat.

37-2.04C(1)(b) Definitions

Reserved

37-2.04C(1)(c) Submittals

At least 10 days before starting polymer asphaltic emulsion seal coat application, submit a signed copy of the test result report of the Vialit test method for aggregate retention in chip seals (french chip) to the Engineer and to:

DEPARTMENT OF TRANSPORTATION
Division of Maintenance, Roadway Maintenance Office
1120 N Street, MS 31
Sacramento, CA 95814

37-2.04C(1)(d) Quality Control and Assurance

The authorized laboratory must test screenings for retention under the Vialit test method for aggregate in chip seals (french chip). The Vialit test results are not used for acceptance. The Vialit test is available at the METS Web site.

If the test results for polymer asphaltic emulsion do not comply with the specifications, the Engineer assesses a pay factor value for the following properties and increments:

Polymer Asphaltic Emulsion Pay Factor Table

Test method and property	Increment	Pay factor
Test on polymer asphaltic emulsion		
AASHTO T 59 (Viscosity, sec Saybolt Furol, at 50 °C)	Each 10 seconds above max or below min	1
AASHTO T 59 (settlement, 5 days, percent)	Each 1.5 percent above max	1
AASHTO T 59 (sieve test, percent max)	Each 0.2 percent above max	1
AASHTO T 59 (demulsibility percent)	Each 2 percent below min	1
Test on residue from evaporation test		
AASHTO T 49 (penetration, 25 °C)	Each 2 dm above max or below min	1
ASTM D 36 (field softening point °C)	2 °C below min	1
California Test 332 (torsional recovery ^a)	For each 1 increment below the min value of 18	1
	For each 2 increments below the min value of 18	3
	For each 3 or more increments below the min value of 18	10
ASTM T 301 (elastic recovery ^a)	For each 1 increment below the min value of 60	1
	For each 2 increment below the min value of 60	3
	For each 3 increment below the min value of 60	10

^a The highest pay factor applies

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The Engineer assesses a pay factor of 1 for sampling not performed in compliance with the specifications, including shipping and sampling containers.

For polymer asphaltic emulsion seal coat, if a test result for the screenings cleanness value is from 75 to 86, you may request that the asphaltic emulsion seal coat represented by the test remain in place. A payment deduction is made as specified in section 37-2.04D. If the screenings cleanness value is less than 75, remove the asphaltic emulsion seal coat.

37-2.04C(2) Materials

Polymer asphaltic emulsion must include elastomeric polymer.

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Polymer asphaltic emulsion must comply with section 94, Table 3, under the test on residue from evaporation test for Grades PMRS2, PMRS2h, PMCRS2, and PMCRS2h and the following:

1. The penetration at 39.2 degrees F (200g for 60 seconds) determined under AASHTO T 49 must be at least 6.
2. Elastic recovery determined under AASHTO T 301 must be at least 60 percent.
3. Polymer content in percent by weight does not apply.
4. The ring and ball softening point temperature determined under AASHTO T 53 for Test on Residue from Evaporation Test must comply with the following minimum temperature requirement:
 - 4.1. 126 degrees F for a geographical ambient temperature from 32 to 104 degrees F
 - 4.2. 129 degrees F for a geographical ambient temperature from 18 to 104 degrees F
 - 4.3. 135 degrees F for a geographical ambient temperature from 18 to greater than 104 degrees F

Screenings for polymer asphaltic emulsion seal coat must have the gradation as determined under California Test 202 in the following table:

Polymer Asphaltic Emulsion Seal Coat Screenings Gradation

Sieve sizes	Percentage passing			
	Coarse 1/2" max	Medium 3/8" max	Medium fine 5/16" max	Fine 1/4" max
3/4"	100	--	--	--
1/2"	85–100	100	--	--
3/8"	0–30	85–100	100	100
No. 4	0–5	0–15	0–50	60–85
No. 8	--	0–5	0–15	0–25
No. 16	--	--	0–5	0–5
No. 30	--	--	0–3	0–3
No. 200	0–2	0–2	0–2	0–2

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The cleanness value determined under California Test 227 must be 86 or greater.

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37-2.04C(3) Construction

Polymer asphaltic emulsion must be applied within the application rate ranges shown in the following table:

Polymer Asphaltic Emulsion Application Rates

Screenings	Application rate range(gallons per square yard)
Fine	0.15–0.30
Medium fine	0.25–0.35
Medium	0.25–0.40
Coarse	0.30–0.40

Apply polymer asphaltic emulsion when the ambient air temperature is from 60 to 105 degrees F and the pavement surface temperature is at least 55 degrees F.

Do not apply polymer asphaltic emulsion when weather forecasts predict the ambient air temperature will fall below 39 degrees F within 24 hours after application.

For double asphaltic emulsion seal coat, polymer asphaltic emulsion must be applied within the application rates shown in the following table:

Polymer Asphaltic Emulsion Application Rates

Screenings	Application rate range (gal/sq yd)
Double	
1st application	0.20–0.35
2nd application	0.20–0.30

You may stockpile screenings for polymer emulsion seal coat if you prevent contamination. Screenings must have damp surfaces at spreading. If water visibly separates from the screenings, do not spread. You may redampen them in the delivery vehicle.

Spread screenings before the polymer emulsion sets or breaks.

Spread screenings within 10 percent of the rate determined by the Engineer. Screenings must have a spread rate within the ranges shown in the following table:

Screening Spread Rates

Seal coat type	Range (lb/sq yd)
Fine	12–20
Medium fine	16–25
Medium	20–30
Coarse	23–30

Do not spread screenings more than 2,500 feet ahead of the completed initial rolling.

For double seal coat, screenings must have a spread rate within the ranges shown in the following table:

Screening Spread Rates

Seal coat type	Range (lb/sq yd)
Double	
1st application	23–30
2nd application	12–20

Remove excess screenings on the 1st application before the 2nd application of asphaltic emulsion.

37-2.04C(4) Payment

If polymer asphaltic emulsion seal coat with screenings does not comply with the specifications for cleanness value you may request that the seal coat remain in place with a pay deduction corresponding by the cleanness value shown in the following table:

Polymer Asphaltic Emulsion Seal Coat Cleanness Value Deductions

Cleanness value	Deduction
86 or over	None
81–85	\$2.20/ton
77–80	\$4.40/ton
75–76	\$6.60/ton

If test results for polymer asphaltic emulsion aggregate grading and cleanness value test results do not comply with the specifications, all deductions are made. A test for polymer asphaltic emulsion represents the smaller of 55 tons or 1 day's production. A test for the screenings grading or cleanness value represents the smaller of 300 tons or 1 day's production.

The payment deduction for noncompliant polymer asphaltic emulsion is based on the total pay factor value determined from the table titled, "Polymer Asphaltic Emulsion Pay Factor Deduction." You must remove polymer asphaltic emulsion seal coat with a pay factor value greater than 20. You may request seal coat with noncompliant polymer asphaltic emulsion to remain in place with a pay deduction for the total pay factor value shown in the following table:

Polymer Asphaltic Emulsion Pay Factor Deductions

Total pay factor value	Deduction
0	none
1–2	\$5.00/ton
3–5	\$10.00/ton
6–9	\$15.00/ton
10–14	\$25.00/ton
15–20	\$50.00/ton

37-2.05 ASPHALT BINDER SEAL COATS

37-2.05A General

Reserved

37-2.05B Asphalt Rubber Binder Seal Coats

37-2.05B(1) General

37-2.05B(1)(a) Summary

Section 37-2.05B includes specifications for applying asphalt rubber binder seal coat. Asphalt rubber seal coat includes applying heated asphalt rubber binder, followed by heated screenings precoated with asphalt binder, followed by a flush coat.

37-2.05B(1)(b) Definitions

crumb rubber modifier: Ground or granulated high natural crumb rubber or scrap tire crumb rubber.

descending viscosity reading: Subsequent viscosity reading at least 5 percent lower than the previous viscosity reading.

high natural crumb rubber: Material containing 40 to 48 percent natural rubber.

scrap tire crumb rubber: Any combination of:

1. Automobile tires
2. Truck tires
3. Tire buffing

37-2.05B(1)(c) Submittals

For each delivery of asphalt rubber binder ingredients and asphalt rubber binder to the job site, submit a certificate of compliance and a copy of the specified test results.

Submit MSDS for each asphalt rubber binder ingredient and the asphalt rubber binder.

At least 15 days before use, submit:

1. Four 1-quart cans of mixed asphalt rubber binder
2. Samples of each asphalt rubber binder ingredient
3. Asphalt rubber binder formulation and data as follows:
 - 3.1. For asphalt binder and asphalt modifier submit:
 - 3.1.1. Source and grade of asphalt binder
 - 3.1.2. Source and type of asphalt modifier
 - 3.1.3. Percentage of asphalt modifier by weight of asphalt binder
 - 3.1.4. Percentage of combined asphalt binder and asphalt modifier by weight of asphalt rubber binder
 - 3.1.5. Test results for the specified quality characteristics
 - 3.2. For crumb rubber modifier submit:
 - 3.2.1. Each source and type of scrap tire crumb rubber and high natural rubber
 - 3.2.2. Percentage of scrap tire crumb rubber and high natural rubber by total weight of asphalt rubber binder
 - 3.2.3. Test results for the specified quality characteristics
 - 3.3. For asphalt rubber binder submit:
 - 3.3.1. Test results for the specified quality characteristics
 - 3.3.2. Minimum reaction time and temperature

At least 5 business days before use, submit the permit issued by the local air quality agency for asphalt rubber binder:

1. Field blending equipment
2. Application equipment

If an air quality permit is not required by the local air quality agency for producing asphalt rubber binder or spray applying asphalt rubber binder, submit verification from the local air quality agency that an air quality permit is not required for this Contract.

Submit a certified volume or weight slip for each delivery of asphalt rubber binder ingredients and asphalt rubber binder.

Submit a certificate of compliance and accuracy verification of test results for viscometers.

When determined by the Engineer, submit notification 15 minutes before each viscosity test or submit a schedule of testing times.

Submit the log of asphalt rubber binder viscosity test results each day of asphalt rubber seal coat work.

37-2.05B(1)(d) Quality Control and Assurance

Equipment used in producing asphalt rubber binder must be permitted for use by the local air quality agency. Equipment used in spreading asphalt rubber binder must be permitted for use by the local air quality agency.

Each asphalt rubber binder ingredient must be sampled and tested for compliance with the specifications by the manufacturer.

Test and submit results at least once per project or the following, whichever frequency is greater:

1. For crumb rubber modifier except for grading, at least once per 250 tons. Samples of scrap tire crumb rubber and high natural crumb rubber must be sampled and tested separately. Test each delivery of crumb rubber modifier for grading.
2. For asphalt binder, test and submit at least once per 200 tons of asphalt binder production.
3. For asphalt modifier, test and submit at least once per 25 tons of asphalt modifier production.

Scrap tire crumb rubber and high natural crumb rubber must be delivered to the asphalt rubber production site in separate bags.

Take viscosity readings of asphalt rubber binder under ASTM D7741 during asphalt rubber binder production. Start taking viscosity readings of samples taken from the reaction vessel at least 45 minutes after adding crumb rubber modifier and continue taking viscosity readings every 30 minutes until 2 consecutive descending viscosity readings have been obtained and the final viscosity meets the specification requirement. After meeting the 2 descending viscosity readings requirement, continue to take viscosity readings hourly and within 15 minutes before use. Log the test results, including time of testing and temperature of the asphalt rubber binder.

37-2.05B(2) Material

37-2.05B(2)(a) General

Reserved

37-2.05B(2)(b) Asphalt Binder

Asphalt binder must comply with the specifications for asphalt binder. Do not modify asphalt binder with polymer.

37-2.05B(2)(c) Asphalt Modifier

Asphalt modifier must be a resinous, high flash point, and aromatic hydrocarbon. Asphalt modifier must have the values for the quality characteristics shown in the following table:

Asphalt Modifier for Asphalt Rubber Binder

Quality characteristic	Test method	Value
Viscosity, m ² /s (x 10 ⁻⁶) at 100 °C	ASTM D 445	X ± 3 ^a
Flash point, CL.O.C., °C	ASTM D 92	207 min
Molecular analysis		
Asphaltenes, percent by mass	ASTM D 2007	0.1 max
Aromatics, percent by mass	ASTM D 2007	55 min

^a "X" denotes the proposed asphalt modifier viscosity from 19 to 36. A change in "X" requires a new asphalt rubber binder submittal.

37-2.05B(2)(d) Crumb Rubber Modifier

Crumb rubber modifier must be ground or granulated at ambient temperature.

Scrap tire crumb rubber and high natural crumb rubber must be delivered to the asphalt rubber binder production site in separate bags.

Steel and fiber must be separated. If steel and fiber are cryogenically separated, it must occur before grinding and granulating. Cryogenically-produced crumb rubber modifier particles must be large enough to be ground or granulated.

Wire must not be more than 0.01 percent by weight of crumb rubber modifier. Crumb rubber modifier must be free of contaminants except fabric, which must not exceed 0.05 percent by weight of crumb rubber modifier. Method for determining the percent weight of wire and fabric is available under Laboratory Procedure 10 at the following METS Web site:

<http://www.dot.ca.gov/hq/esc/Translab/ofpm/fpmlab.htm>

The length of an individual crumb rubber modifier particle must not exceed 3/16 inch.

Crumb rubber modifier must be dry, free-flowing particles that do not stick together. A maximum of 3 percent calcium carbonate or talc by weight of crumb rubber modifier may be added. Crumb rubber modifier must not cause foaming when combined with the asphalt binder and asphalt modifier.

Specific gravity of crumb rubber modifier must be from 1.1 to 1.2 determined under California Test 208.

When tested under ASTM D 297, crumb rubber modifier must comply with the requirements shown in the following table:

Crumb Rubber Modifier

Quality characteristic	Scrap tire crumb rubber (percent)		High natural rubber (percent)	
	Min	Max	Min	Max
Acetone extract	6.0	16.0	4.0	16.0
Rubber hydrocarbon	42.0	65.0	50.0	--
Natural rubber content	22.0	39.0	40.0	48.0
Carbon black content	28.0	38.0	--	--
Ash content	--	8.0	--	--

Scrap tire crumb rubber must have the gradation shown in the following table:

Scrap Tire Crumb Rubber Gradation
Percentage passing

Sieve size	Gradation limit	Operating range	Contract compliance
No. 8	100	100	100
No. 10	98–100	95–100	90–100
No. 16	45–75	35–85	32–88
No. 30	2–20	2–25	1–30
No. 50	0–6	0–10	0–15
No. 100	0–2	0–5	0–10
No. 200	0	0–2	0–5

High natural crumb rubber must have the gradation shown in the following table:

High Natural Crumb Rubber Gradation
Percentage passing

Sieve size	Gradation limit	Operating range	Contract compliance
No. 10	100	100	100
No. 16	95–100	92–100	85–100
No. 30	35–85	25–95	20–98
No. 50	10–30	6–35	2–40
No. 100	0–4	0–7	0–10
No. 200	0–1	0–3	0–5

Test the crumb rubber modifier gradation under ASTM C 136 except

- Split or quarter 100 ± 5 g from the crumb rubber modifier sample and dry to a constant mass at a temperature from 57 to 63 degrees C and record the dry sample mass. Place the crumb rubber modifier sample and 5 g of talc in a 1/2-liter jar. Seal the jar, then shake the jar by hand for at least 1 minute to mix the crumb rubber modifier and the talc. Continue shaking or open the jar and stir until the particle agglomerates and clumps are broken and the talc is uniformly mixed.
- Place 1 rubber ball on each sieve. Each ball must weigh 8.5 ± 0.5 g, measure 24.5 ± 0.5 mm in diameter, and have a Shore Durometer "A" hardness of 50 ± 5 determined under ASTM D 2240. After sieving the combined material for 10 ± 1 minutes, disassemble the sieves. Brush material adhering to the bottom of a sieve into the next finer sieve. Weigh and record the mass of the material retained on the 2.36-millimeter sieve and leave this material (do not discard) on the scale or balance. Fabric balls must remain on the scale or balance and be placed together on the side to prevent them from being covered or disturbed when the material from finer sieves is placed onto the scale or balance. The material retained on the 2.00-millimeter sieve must be added to the scale or balance. Weigh and record that mass as the accumulative mass retained on the 2.00-millimeter sieve. Continue weighing and recording the accumulated masses retained on the remaining sieves until the accumulated mass retained in the pan has been determined. Before discarding the crumb rubber modifier sample, separately weigh and record the total mass of fabric balls in the sample.
- Determine the mass of material passing the 75-micrometer sieve by subtracting the accumulated mass retained on the 75-micrometer sieve from the accumulated mass retained in the pan. If the material passing the 75-micrometer sieve has a mass of 5 g or less, cross out the recorded number for the accumulated mass retained in the pan and copy the number recorded for the accumulated mass retained on the 75-micrometer sieve and record that number, next to the crossed out number, as the accumulated mass retained in the pan. If the material passing the 75-micrometer sieve has a mass greater than 5 g, cross out the recorded number for the accumulated mass retained in the pan, subtract 5 g from that number and record the difference next to the crossed out number. The adjustment to the accumulated mass retained in the pan accounts for the 5 g of talc added to the sample. For calculation purposes, the adjusted total sample mass is the same as the adjusted

accumulated mass retained in the pan. Determine the percent passing based on the adjusted total sample mass and record to the nearest 0.1 percent.

37-2.05B(2)(e) Asphalt Rubber Binder

Asphalt rubber binder must be a combination of:

1. Asphalt binder
2. Asphalt modifier
3. Crumb rubber modifier

Asphalt rubber binder blending equipment must be authorized under the Department's material plant quality program.

The blending equipment must allow the determination of weight percentages of each asphalt rubber binder ingredient.

Asphalt rubber binder must be 79 ± 1 percent by weight asphalt binder and 21 ± 1 percent by weight of crumb rubber modifier. The minimum percentage of crumb rubber modifier must be 20.0 percent and lower values may not be rounded up.

Crumb rubber modifier must be 76 ± 2 percent by weight scrap tire crumb rubber and 24 ± 2 percent by weight high natural rubber.

Asphalt modifier and asphalt binder must be blended at the production site. Asphalt modifier must be from 2.5 to 6.0 percent by weight of the asphalt binder in the asphalt rubber binder. The asphalt rubber binder supplier determines the exact percentage.

If blended, the asphalt binder must be from 375 to 440 degrees F when asphalt modifier is added and the mixture must circulate for at least 20 minutes. Asphalt binder, asphalt modifier, and crumb rubber modifier may be proportioned and combined simultaneously.

The blend of asphalt binder and asphalt modifier must be combined with crumb rubber modifier at the asphalt rubber binder production site. The asphalt binder and asphalt modifier blend must be from 375 to 440 degrees F when crumb rubber modifier is added. Combined ingredients must be allowed to react at least 45 minutes at temperatures from 375 to 425 degrees F except the temperature must be at least 10 degrees F below the flash point of the asphalt rubber binder.

After reacting, the asphalt rubber binder must have the values for the quality characteristics shown in the following table:

Asphalt Rubber Binder			
Quality characteristic	Test method	Requirement	
		Min	Max
Cone penetration @ 25 °C, 1/10 mm	ASTM D 217	25	60
Resilience @ 25 °C, percent rebound	ASTM D 5329	18	50
Field softening point, °C	ASTM D 36	55	88
Viscosity @190 °C, Pa • s ($\times 10^{-3}$)	ASTM D 7741	1500	2500

Maintain asphalt rubber binder at a temperature from 375 to 415 degrees F.

Stop heating unused asphalt rubber binder 4 hours after the 45-minute reaction period. Reheating asphalt rubber binder that cools below 375 degrees F is a reheat cycle. Do not exceed 2 reheat cycles. If reheating, asphalt rubber binder must be from 375 to 415 degrees F before use.

During reheating, you may add scrap tire crumb rubber. Scrap tire crumb rubber must not exceed 10 percent by weight of the asphalt rubber binder. Allow added scrap tire crumb rubber to react for at least 45 minutes. Reheated asphalt rubber binder must comply with the specifications for asphalt rubber binder.

37-2.05B(2)(f) Screenings

Before precoating with asphalt binder and when tested under California Test 202, screenings for asphalt rubber seal coat must have the gradation shown in the following table:

Sieve sizes	Percentage passing by weight		
	Coarse 1/2" max	Medium 1/2" max	Fine 3/8" max
3/4"	100	100	100
1/2"	75–90	85–90	95–100
3/8"	0–20	0–30	70–85
No. 4	0–2	0–5	0–15
No. 8	--	--	0–5
No. 200	0–1	0–1	0–1

Screenings must have the values for the properties shown in the following table:

Properties	Test method	Value
Cleanness value, min	California Test 227	80
Durability, min	California Test 229	52

37-2.05B(3) Construction

37-2.05B(3)(a) General

Reserved

37-2.05B(3)(b) Equipment

Self-propelled distributor truck for applying asphalt rubber binder must have the following features:

1. Heating unit
2. Internal mixing unit
3. Pumps that spray asphalt rubber binder within 0.05 gal/sq yd of the specified rate
4. Fully circulating spray bar that applies asphalt rubber binder uniformly
5. Tachometer
6. Pressure gages
7. Volume measuring devices
8. Thermometer
9. Observation platform on the rear of the truck for an observer on the platform to see the nozzles and unplug them if needed

37-2.05B(3)(c) Precoating Screenings

For asphalt rubber seal coat, do not recombine fine materials collected in dust control systems except cyclone collectors or knock-out boxes with any other aggregate used in the production of screenings.

For asphalt rubber seal coat, screenings must be preheated from 260 to 325 degrees F. Coat with any of the asphalts specified in the table titled "Performance Graded Asphalt Binder" in section 92. Coat at a central mixing plant. The asphalt must be from 0.5 to 1.0 percent by weight of dry screenings. The Engineer determines the exact rate.

Plant must be authorized under the Department's material plant quality program.

Do not stockpile preheated or precoated screenings.

37-2.05B(3)(d) Asphalt Rubber Binder Application

Apply asphalt rubber binder immediately after the reaction period. At the time of application, the temperature of asphalt rubber binder must be from 385 to 415 degrees F.

Apply asphalt rubber binder at a rate from 0.55 to 0.65 gal/sq yd. The Engineer determines the exact rate.

Apply asphalt rubber binder when the atmospheric temperature is from 60 to 105 degrees F and the pavement surface temperature is at least 55 degrees F.

Do not apply asphalt rubber binder unless there are sufficient screenings available to cover the asphalt rubber binder within 2 minutes. Intersections, turn lanes, gore points, and irregular areas must be covered within 15 minutes.

Do not apply asphalt rubber binder when weather or road conditions are unsuitable, including high wind or when the pavement is damp. In windy conditions you may adjust the distributor bar height and distribution speed, and use shielding equipment, if the Engineer authorizes your request.

37-2.05B(3)(e) Screenings Application

During transit, cover precoated screenings for asphalt rubber seal coat with tarpaulins if the ambient air temperature is below 65 degrees F or the haul time exceeds 30 minutes.

At the time of application, screenings for asphalt rubber seal coat must be from 225 to 325 degrees F.

Spread screenings at a rate from 28 to 40 lb/sq yd. The exact rate is determined by the Engineer. Spread to within 10 percent of the determined rate.

37-2.05B(3)(f) Rolling and Sweeping

Perform initial rolling within 90 seconds of spreading screenings. Do not spread screenings more than 200 feet ahead of the initial rolling.

For final rolling, you may request use of a steel-wheeled roller weighing from 8 to 10 tons, static mode only.

Perform a final sweeping before Contract acceptance. The final sweeping must not dislodge screenings.

Dispose of swept screenings at least 150 feet from any waterway.

37-2.05B(4) Payment

Screenings for asphalt rubber seal coat are measured by coated weight after they are preheated and precoated with asphalt binder. The weight of screenings must be the coated weight.

If recorded batch weights are printed automatically, the bid item for screenings for asphalt-rubber seal coat are measured using the printed batch weights, provided:

1. Total aggregate weight for screenings per batch is printed
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 are correlated with a load slip
5. A copy of the recorded batch weights is certified by a licensed weighmaster and submitted to the Engineer

Screenings for asphalt rubber seal coat is paid for as precoated screenings.

Asphalt-rubber binder is measured under the specifications for asphalts.

If test results for gradation tests do not comply with the specifications, deductions are taken.

Each gradation test for scrap tire crumb rubber represents 10,000 lbs or the amount used in that day's production, whichever is less.

Each gradation test for high natural rubber represents 3,400 lbs or the amount used in that day's production, whichever is less.

For each gradation test, the following pay deductions will be taken from the asphalt rubber bid item:

Add to the end of the paragraph in section 39-1.02A:

10-19-12

as shown

Replace "less than 10 percent" in note "b" in the table in the 5th paragraph of section 39-1.02E with:

01-20-12

10 percent or less

Replace the paragraphs in section 39-1.02F with:

02-22-13

39-1.02F(1) General

You may produce HMA Type A or B using 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 at a substitution rate not exceeding 25 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 JMF submittal. The JMF must include the percent of RAP used.

Provide enough space for meeting RAP handling requirements at your facility. Provide a clean, graded, well-drained area for stockpiles. Prevent material contamination and segregation.

If RAP is from multiple sources, blend the RAP thoroughly and completely. RAP stockpiles must be homogeneous.

Isolate the processed RAP stockpiles from other materials. Store processed RAP in conical or longitudinal stockpiles. Processed RAP must not be agglomerated or be allowed to congeal in large stockpiles.

AASHTO T 324 (Modified) is AASHTO T 324, "Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)," with the following parameters:

07-19-13

1. Target air voids must equal 7 ± 1 percent
2. Specimen height must be $60 \text{ mm} \pm 1 \text{ mm}$
3. Number of test specimens must be 4
4. Test specimen must be a 150mm gyratory compacted specimen
5. Test temperature must be set at:
 - 5.1. 122 ± 2 degrees F for PG 58
 - 5.2. 131 ± 2 degrees F for PG 64
 - 5.3. 140 ± 2 degrees F for PG 70 and above
6. Measurements for impression must be taken at every 100 passes
7. Inflection point defined as the number of wheel passes at the intersection of the creep slope and the stripping slope
8. Testing shut off must be set at 25,000 passes

02-22-13

39-1.02F(2) Substitution Rate of 15 Percent or Less

For a RAP substitution rate of 15 percent or less, you may stockpile RAP during the entire project.

39-1.02F(3) Substitution Rate Greater than 15 Percent

07-19-13

For a RAP substitution rate greater than 15 percent, fractionate RAP into 2 sizes, a coarse fraction RAP retained on 3/8-inch screen and a fine fraction RAP passing 3/8-inch screen.

Sample and test processed RAP at a minimum frequency of 1 sample per 1000 tons with a minimum of 6 samples for each processed RAP stockpile. If a processed RAP stockpile is augmented, sample and test processed RAP quality characteristics at a minimum frequency of 1 sample per 500 tons of augmented RAP.

When tested under California Test 202 with a total mechanical shaking time of 10 minutes \pm 15 seconds, the processed RAP must meet the grading requirements shown in the following table:

**Processed RAP Gradation
(Percentage Passing)**

Sieve sizes	TV limits	Allowable tolerance
1/2"	100	--
3/8"	97	TV + 3

02-22-13

The processed RAP asphalt binder content must be within \pm 2.0 percent of the average processed RAP stockpile asphalt binder content when tested under ASTM D 2172, Method B. If a new processed RAP stockpile is required, the average binder content of the new processed RAP stockpile must be within \pm 2.0 percent of the average binder content of the original processed RAP stockpile.

The maximum specific gravity for processed RAP must be within \pm 0.06 when tested under California Test 309 of the average maximum specific gravity reported on page 4 of your *Contractor Hot Mix Asphalt Design Data* form.

Replace items 7 and 8 in the 5th paragraph of section 39-1.03A with:

02-22-13

7. Substitution rate by more than 5 percent if your assigned RAP substitution rate is 15 percent or less
8. Substitution rate by more than 3 percent if your assigned RAP substitution rate is greater than 15 percent
9. Average binder content by more than 2 percent from the average binder content of the original processed RAP stockpile used in the mix design
10. Maximum specific gravity of processed RAP by more than \pm 0.060 from the average maximum specific gravity of processed RAP reported on page 4 of your *Contractor Hot Mix Asphalt Design Data* form
11. Any material in the JMF

Replace the 1st paragraph of section 39-1.03B with:

02-22-13

Perform a mix design that produces HMA with the values for the quality characteristics shown in the following table:

HMA Mix Design Requirements

Quality characteristic	Test method	HMA type		
		A	B	RHMA-G
Air void content (%)	California Test 367	4.0	4.0	Section 39-1.03B
Voids in mineral aggregate (% min.)	California Test 367			
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
3/4" grading		13.0	13.0	18.0–23.0
Voids filled with asphalt (%)	California Test 367			Note a
No. 4 grading		65.0–75.0	65.0–75.0	
3/8" grading		65.0–75.0	65.0–75.0	
1/2" grading		65.0–75.0	65.0–75.0	
3/4" grading		65.0–75.0	65.0–75.0	
Dust proportion	California Test 367			Note a
No. 4 and 3/8" gradings		0.6–1.2	0.6–1.2	
1/2" and 3/4" gradings		0.6–1.2	0.6–1.2	
Stabilometer value (min.)	California Test 366			
No. 4 and 3/8" gradings		30	30	--
1/2" and 3/4" gradings		37	35	23

^a Report this value in the JMF submittal.

For RAP substitution rate greater than 15 percent, the mix design must comply with the additional quality characteristics shown in the following table:

Additional HMA Mix Design Requirements for RAP Substitution Rate Greater Than 15 Percent

Quality characteristic	Test method	HMA type		
		A	B	RHMA-G
Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth)	AASHTO T 324 (Modified) ^a			
PG-58		10,000	10,000	--
PG-64		15,000	15,000	
PG-70		20,000	20,000	
PG-76 or higher		25,000	25,000	
Hamburg wheel track (inflection point minimum number of passes)	AASHTO T 324 (Modified) ^a			
PG-58		10,000	10,000	--
PG-64		10,000	10,000	
PG-70		12,500	12,500	
PG-76 or higher		15000	15000	
Moisture susceptibility (minimum dry strength, psi)	California Test 371 ^a	120	120	--
Moisture susceptibility (tensile strength ration, %)	California Test 371 ^a	70	70	--

^a Test plant produced HMA.

For HMA with RAP, the maximum binder replacement must be 25.0 percent of OBC for surface course and 40.0 percent of OBC for lower courses.

For HMA with a binder replacement less than or equal to 25 percent of OBC, you may request that the PG asphalt binder grade with upper and lower temperature classifications be reduced by 6 degrees C from the specified grade.

For HMA with a binder replacement greater than 25 percent but less than or equal to 40 percent of OBC, you must use a PG asphalt binder grade with upper and lower temperature classifications reduced by 6 degrees C from the specified grade.

Replace item 4 in the list in the 1st paragraph of section 39-1.03C with:

4. JMF renewal on a *Caltrans Job Mix Formula Renewal* form, if applicable

01-20-12

Add to the end of section 39-1.03C:

For RAP substitution rate greater than 15 percent, submit with the JMF submittal:

02-22-13

1. California Test 371 tensile strength ratio and minimum dry strength test results
2. AASHTO T 324 (Modified) test results

For RAP substitution rate greater than 15 percent, submit California Test 371 and AASHTO T 324 (Modified) test results to the Engineer and to:

Moisture_Tests@dot.ca.gov

Replace the 2nd paragraph of section 39-1.03E with:

Use the OBC specified on your *Contractor Hot Mix Asphalt Design Data* form. No adjustments to asphalt binder content are allowed. Based on your testing and production experience, you may submit an adjusted aggregate gradation TV on a *Contractor Job Mix Formula Proposal* form before verification testing. Aggregate gradation TV must be within the TV limits specified in the aggregate gradation tables.

04-20-12

Add between the 3rd and 4th paragraphs of section 39-1.03E:

Asphalt binder set point for HMA must be the OBC specified on your *Contractor Hot Mix Asphalt Design Data* form. When RAP is used, asphalt binder set point for HMA must be:

04-20-12

$$\text{Asphalt Binder Set Point} = \frac{\frac{BC_{OBC}}{\left(1 - \frac{BC_{OBC}}{100}\right)} - R_{RAP} \left[\frac{BC_{RAP}}{\left(1 - \frac{BC_{RAP}}{100}\right)} \right]}{100 + \frac{BC_{OBC}}{\left(1 - \frac{BC_{OBC}}{100}\right)}}$$

Where:

BC_{OBC} = optimum asphalt binder content, percent based on total weight of mix

R_{RAP} = RAP ratio by weight of aggregate

BC_{RAP} = asphalt binder content of RAP, percent based on total weight of RAP mix

Replace item 4 in the list in the 8th paragraph of section 39-1.03E with:

4. HMA quality specified in the table titled "HMA Mix Design Requirements" except:
 - 4.1. Air void content, design value ± 2.0 percent
 - 4.2. Voids filled with asphalt, report only

04-20-12

4.3. Dust proportion, report only

Replace the 12th paragraph of section 39-1.03E with:

04-20-12

If tests on plant-produced samples do not verify the JMF, the Engineer notifies you and you must submit a new JMF or submit an adjusted JMF based on your testing. JMF adjustments may include a change in aggregate gradation TV within the TV limits specified in the aggregate gradation tables.

Replace the 14th paragraph of section 39-1.03E with:

01-20-12

A verified JMF is valid for 12 months.

Replace the last sentence in the 15th paragraph of section 39-1.03E with:

01-20-12

This deduction does not apply to verifications initiated by the Engineer or JMF renewal.

Replace the 16th paragraph of section 39-1.03E with:

02-22-13

Except for RAP substitution rate greater than 15 percent, for any HMA produced under the QC/QA process the Department does not use California Test 371 test results for verification.

Add between the 1st and 2nd paragraphs of section 39-1.03F:

04-20-12

Target asphalt binder content on your Contractor *Job Mix Formula Proposal* form and the OBC specified on your *Contractor Hot Mix Asphalt Design Data* form must be the same.

Delete the 4th paragraph of section 39-1.03F.

01-20-12

Replace items 3 and 5 in the list in the 6th paragraph of section 39-1.03F with:

01-20-12

3. Engineer verifies each proposed JMF renewal within 20 days of receiving verification samples.
5. For each HMA type and aggregate gradation specified, the Engineer verifies at the Department's expense 1 proposed JMF renewal within a 12-month period.

Add between the 6th and 7th paragraphs of section 39-1.03F:

01-20-12

The most recent aggregate quality test results within the past 12 months may be used for verification of JMF renewal or the Engineer may perform aggregate quality tests for verification of JMF renewal.

Replace section 39-1.03G with:

04-20-12

39-1.03G Job Mix Formula Modification

For an accepted JMF, you may change asphalt binder source one time during production.

Submit your modified JMF request a minimum of 3 business days before production. Each modified JMF submittal must consist of:

1. Proposed modified JMF on *Contractor Job Mix Formula Proposal* form
2. Mix design records on *Contractor Hot Mix Asphalt Design Data* form for the accepted JMF to be modified
3. JMF verification on *Hot Mix Asphalt Verification* form for the accepted JMF to be modified
4. Quality characteristics test results for the modified JMF as specified in section 39-1.03B. Perform tests at the mix design OBC as shown on the *Contractor Asphalt Mix Design Data* form
5. If required, California Test 371 test results for the modified JMF.

With an accepted modified JMF submittal, the Engineer verifies each modified JMF within 5 business days of receiving all verification samples. If California Test 371 is required, the Engineer tests for California Test 371 within 10 days of receiving verification samples.

The Engineer verifies the modified JMF after the modified JMF HMA is placed on the project and verification samples are taken within the first 750 tons following sampling requirements in section 39-1.03E, "Job Mix Formula Verification." The Engineer tests verification samples for compliance with:

1. Stability as shown in the table titled "HMA Mix Design Requirements"
2. Air void content at design value ± 2.0 percent
3. Voids in mineral aggregate as shown in the table titled "HMA Mix Design Requirements"
4. Voids filled with asphalt, report only
5. Dust proportion, report only

If the modified JMF is verified, the Engineer revises your *Hot Mix Asphalt Verification* form to include the new asphalt binder source. Your revised form will have the same expiration date as the original form.

If a modified JMF is not verified, stop production and any HMA placed using the modified JMF is rejected.

The Engineer deducts \$2,000 from payments for each modified JMF verification. The Engineer deducts an additional \$2,000 for each modified JMF verification that requires California Test 371.

Add to section 39-1.03:

01-20-12

39-1.03H 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.

Replace "3 days" in the 1st paragraph of section 39-1.04A with:

01-20-12

3 business days

Replace the 2nd sentence in the 2nd paragraph of section 39-1.04A with:

01-20-12

During production, take samples under California Test 125. You may sample HMA from:

Replace "batch" in the 2nd sentence in the 2nd paragraph of section 39-1.04C with:

07-19-13

lot. Each asphalt binder lot consist of 1 or multiple batches of combined asphalt binder, asphalt modifier, and CRM proportioned under section 39-1.02D.

Replace the 2nd paragraph of section 39-1.04E with:

02-22-13

For RAP substitution rate of 15 percent or less, sample RAP once daily.

For RAP substitution rate of greater than 15percent, sample processed RAP twice daily.

Perform QC testing for processed RAP aggregate gradation under California Test 367, appendix B, and submit the results with the combined aggregate gradation.

Replace "5 days" in the 1st paragraph of section 39-1.06 with:

01-20-12

5 business days

Replace the 3rd paragraph of section 39-1.08A with:

04-20-12

During production, you may adjust hot or cold feed proportion controls for virgin aggregate and RAP.

Add to section 39-1.08A:

04-20-12

During production, asphalt binder set point for HMA Type A, HMA Type B, HMA Type C, and RHMA-G must be the OBC shown in *Contractor Hot Mix Asphalt Design Data* form. For OGFC, asphalt binder set point must be the OBC shown on *Caltrans Hot Mix Asphalt Verification* form. If RAP is used, asphalt binder set point for HMA must be calculated as specified in section 39-1.03E.

07-19-13

For RAP substitution rate of 15 percent or less, you may adjust the RAP by -5 percent.

For RAP substitution greater than 15, you may adjust the RAP by -3 percent.

04-20-12

You must request adjustments to the plant asphalt binder set point based on new RAP stockpiles average asphalt binder content. Do not adjust the HMA plant asphalt binder set point until authorized.

Replace the 3rd paragraph of section 39-1.08B with:

09-16-11

Asphalt rubber binder must be from 375 to 425 degrees F when mixed with aggregate.

Add to the beginning of section 39-1.08C:

07-19-13

Asphalt rubber binder blending plants must have current qualification under the Department's Material Plant Quality Program.

Replace section 39-1.11 with:

01-18-13

39-1.11 CONSTRUCTION

39-1.11A General

Do not place HMA on wet pavement or a 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, pickup, loading, and paving are continuous
4. HMA temperature in the windrow does not fall below 260 degrees F

You may place 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 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

39-1.11B Longitudinal Joints

39-1.11B(1) General

Longitudinal joints in the top layer must match specified lane edges. Alternate the longitudinal joint offsets in the lower layers at least 0.5 foot from each side of the specified lane edges. You may request other longitudinal joint placement patterns.

A vertical longitudinal joint of more than 0.15 ft is not allowed at any time between adjacent lanes open to traffic.

For HMA thickness of 0.15 ft or less, the distance between the ends of the adjacent surfaced lanes at the end of each day's work must not be greater than can be completed in the following day of normal paving.

For HMA thickness greater than 0.15 ft, you must 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 from 5 to 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 authorized bond breaker under the conform tapers to facilitate the taper removal when paving operations resume.

39-1.11B(2) Tapered Notched Wedge

For divided highways with an HMA lift thickness greater than 0.15 foot, you may construct a 1-foot wide tapered notched wedge joint as a longitudinal joint between adjacent lanes open to traffic. A vertical notch of 0.75 inch maximum must be placed at the top and bottom of the tapered wedge.

The tapered notched wedge must retain its shape while exposed to traffic. Pave the adjacent lane within 1 day.

Construct the tapered portion of the tapered notched wedge with an authorized strike-off device. The strike-off device must provide a uniform slope and must not restrict the main screed of the paver.

You may use a device attached to the screed to construct longitudinal joints that will form a tapered notched wedge in a single pass. The tapered notched wedge must be compacted to a minimum of 91 percent compaction.

Perform QC testing on the completed tapered notch wedge joint as follows:

1. Perform field compaction tests at the rate of 1 test for each 750-foot section along the joint. Select random locations for testing within each 750-foot section.
2. Perform field compaction tests at the centerline of the joint, 6 inches from the upper vertical notch, after the adjacent lane is placed and before opening the pavement to traffic.

3. Determine maximum density test results.
4. Determine percent compaction of the longitudinal joint as the ratio of the average of the field compaction values and the maximum density test results.

For HMA under QC/QA construction process, the additional quality control compaction results associated with the tapered notch wedge will not be included in the computation of any quality factor and process control.

For acceptance of the completed tapered notch wedge joint, take two 4- or 6-inch diameter cores 6 inches from the upper vertical notch of the completed longitudinal joint for every 3,000 feet at locations designated by the Engineer. Take cores after the adjacent lane is placed and before opening the pavement to traffic. Cores must be taken in the presence of the Engineer and must be marked to identify the test sites. Submit the cores. One core will be used for determination of the field density and 1 core will be used for dispute resolution. The Engineer determines:

1. Field compaction by measuring the bulk specific gravity of the cores under California Test 308, Method A
2. Percent compaction as the ratio of the average of the bulk specific gravity of the core for each day's production to the maximum density test value

For HMA under QC/QA construction process, the additional quality assurance testing by the Engineer to determine field compaction associated with the tapered notch wedge will not be included in the Engineer's verification testing and in the computation of any quality factor and process control.

Determine percent compaction values each day the joint is completed and submit values within 24 hours of testing. If the percent compaction of 1 day's production is less than 91 percent, that day's notched wedge joint is rejected. Discontinue placement of the tapered notched wedge and notify the Engineer of changes you will make to your construction process in order to meet the specifications.

For HMA under QC/QA construction process, quantities of HMA placed in the completed longitudinal joint will have a quality factor QF_{QC5} of 1.0.

39-1.11C Widening Existing Pavement

If widening existing pavement, construct new pavement structure to match the elevation of the existing pavement's edge before placing HMA over the existing pavement.

39-1.11D Shoulders, Medians, and Other Road Connections

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 changes, 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.

39-1.11E Leveling

If leveling with HMA is specified, fill and level irregularities and ruts with HMA before spreading HMA over the base, existing surfaces, or bridge decks. You may use mechanical equipment other than a paver for these areas. The equipment must produce uniform smoothness and texture. HMA used to change an existing surface's cross slope or profile is not paid for as 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.

39-1.11F Compaction

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 degrees F for HMA with unmodified binder
2. Below 140 degrees F for HMA with modified binder
3. Below 200 degrees 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 construction processes, if 3/4-inch aggregate grading is specified, you may use a 1/2-inch aggregate grading if the specified total paved thickness is at least 0.15 foot and less than 0.20 foot thick.

Spread and compact HMA under sections 39-3.03 and 39-3.04 if any of the following applies:

1. Specified paved thickness is less than 0.15 foot.
2. Specified paved thickness is less than 0.20 foot and 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 for which the Engineer determines conventional compaction and compaction measurement methods are impeded

Do not open new HMA pavement to public traffic until its mid-depth temperature is below 160 degrees F.

If you request and if authorized, you may cool HMA Type A and Type B with water when rolling activities are complete. Apply water under section 17-3.

Spread sand at a rate from 1 to 2 lb/sq yd 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 90-1.02C(4)(c). Keep traffic off the pavement until spreading sand is complete.

Replace the 5th and 6th paragraphs of section 39-1.12C with:

07-20-12

On tangents and horizontal curves with a centerline radius of curvature 2,000 feet or more, the PI_0 must be at most 2.5 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 5 inches per 0.1-mile section.

Add to section 39-1.12:

01-20-12

39-1.12E Reserved

Add to section 39-1.14:

01-20-12

Prepare the area to receive HMA for miscellaneous areas and dikes, including any excavation and backfill as needed.

Replace "6.8" in item 3 in the list in the 4th paragraph of section 39-1.14 with:

6.4

04-20-12

Replace "6.0" in item 3 in the list in the 4th paragraph of section 39-1.14 with:

5.7

04-20-12

Replace "6.8" in the 1st paragraph of section 39-1.15B with:

6.4

04-20-12

Replace "6.0" in the 1st paragraph of section 39-1.15B with:

5.7

04-20-12

Replace the 1st paragraph of section 39-2.02B with:

Perform sampling and testing at the specified frequency for the quality characteristics shown in the following table:

02-22-13

Minimum Quality Control—Standard Construction Process

Quality characteristic	Test method	Minimum sampling and testing frequency	HMA type			
			A	B	RHMA-G	OGFC
Aggregate gradation ^a	California Test 202	1 per 750 tons and any remaining part at the end of the project	JMF ± Tolerance ^b			
Sand equivalent (min) ^c	California Test 217		47	42	47	--
Asphalt binder content (%)	California Test 379 or 382		JMF±0.40	JMF±0.40	JMF ± 0.40	JMF ± 0.40
HMA moisture content (% max)	California Test 226 or 370	1 per 2,500 tons but not less than 1 per paving day	1.0	1.0	1.0	1.0
Field compaction (% max. theoretical density) ^{d,e}	QC plan	2 per business day (min.)	91–97	91–97	91–97	--
Stabilometer value (min) ^c No. 4 and 3/8" gradings 1/2" and 3/4" gradings	California Test 366	1 per 4,000 tons or 2 per 5 business days, whichever is greater	30	30	--	--
			37	35	23	--
Air void content (%) ^{c, f}	California Test 367		4 ± 2	4 ± 2	TV ± 2	--
Aggregate moisture content at continuous mixing plants and RAP moisture content at continuous mixing plants and batch mixing plants ^g	California Test 226 or 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	California Test 205	As designated in the QC plan. At least once per project	90	25	--	90
			75	--	90	75
Los Angeles Rattler (% max) Loss at 100 rev.	California Test 211		12	--	12	12

Loss at 500 rev.			45	50	40	40
Flat and elongated particles (% max by weight @ 5:1)	California Test 235		Report only	Report only	Report only	Report only
Fine aggregate angularity (% min) ^h	California Test 234		45	45	45	--
Voids filled with asphalt (%) ⁱ No. 4 grading 3/8" grading 1/2" grading 3/4" grading	California Test 367		65.0–75.0 65.0–75.0 65.0–75.0 65.0–75.0	65.0–75.0 65.0–75.0 65.0–75.0 65.0–75.0	Report only	--
Voids in mineral aggregate (% min) ⁱ No. 4 grading 3/8" grading 1/2" grading 3/4" grading	California Test 367		17.0 15.0 14.0 13.0	17.0 15.0 14.0 13.0	-- -- 18.0–23.0 18.0–23.0	--
Dust proportion ^l No. 4 and 3/8" gradings 1/2" and 3/4" gradings	California Test 367		0.6-1.2 0.6–1.2	0.6-1.2 0.6–1.2	Report only	--
Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) ^j PG-58 PG-64 PG-70 PG-76 or higher	AASHTO T 324 (Modified)	1 per 10,000 tons or 1 per project whichever is more	10,000 15,000 20,000 25,000	10,000 15,000 20,000 25,000	--	--
Hamburg wheel track (inflection point minimum number of passes) ^j PG-58 PG-64 PG-70 PG-76 or higher	AASHTO T 324 (Modified)	1 per 10,000 tons or 1 per project whichever is more	10,000 10,000 12,500 15000	10,000 10,000 12,500 15000	--	--
Moisture susceptibility (minimum dry strength, psi) ^j	California Test 371	For RAP ≥15% 1 per 10,000 tons or 1 per project whichever is greater	120	120	--	--
Moisture susceptibility (tensile strength ration, %) ^j	California Test 371	For RAP ≥15% 1 per 10,000 tons or 1	70	70	--	--

		per project whichever is greater				
Smoothness	Section 39-1.12	--	12-foot straight- edge, must grind, and PI ₀			
Asphalt rubber binder viscosity @ 375 °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
CRM	Section 39-1.02D	Section 39-1.04C	--	--	Section 39-1.02D	Section 39-1.02D

^a Determine combined aggregate gradation containing RAP under California Test 367.

^b The tolerances must comply with the allowable tolerances in section 39-1.02E.

^c Report the average of 3 tests from a single split sample.

^d Determine field compaction for any of the following conditions:

1. 1/2-inch, 3/8-inch, or no. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot.
2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

^e To determine field compaction use:

1. In-place density measurements using the method specified in your QC plan.
2. California Test 309 to determine the maximum theoretical density at the frequency specified in California Test 375, Part 5C.

^f 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.

^g For adjusting the plant controller at the HMA plant.

^h The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

ⁱ Report only.

^j Applies to RAP substitution rate greater than 15 percent.

Replace the 1st paragraph of section 39-2.03A with:

02-22-13

The Department samples for acceptance testing and tests for the quality characteristics shown in the following table:

HMA Acceptance—Standard Construction Process

Quality characteristic				Test method	HMA type			
					A	B	RHMA-G	OGFC
Aggregate gradation ^a				California Test 202	JMF ± tolerance ^c			
Sieve	3/4"	1/2"	3/8"					
1/2"	X ^b							
3/8"		X						
No. 4			X					
No. 8	X	X	X					
No. 200	X	X	X					
Sand equivalent (min) ^d				California Test 217	47	42	47	--
Asphalt binder content (%)				California Test 379 or 382	JMF±0.40	JMF±0.40	JMF ± 0.40	JMF ± 0.40
HMA moisture content (% max)				California Test 226 or 370	1.0	1.0	1.0	1.0
Field compaction (% max. theoretical density) ^{e, f}				California Test 375	91–97	91–97	91–97	--
Stabilometer value (min) ^g				California Test 366	30	30	--	--
No. 4 and 3/8" gradings								
1/2" and 3/4" gradings					37	35	23	--
Air void content (%) ^{d, g}				California Test 367	4 ± 2	4 ± 2	TV ± 2	--
Percent of crushed particles				California Test 205				
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				70	20	70	90	
Los Angeles Rattler (% max)				California Test 211	12	--	12	12
Loss at 100 rev.								
Loss at 500 rev.					45	50	40	40
Fine aggregate angularity (% min) ^h				California Test 234	45	45	45	--
Flat and elongated particles (% max by weight @ 5:1)				California Test 235	Report only	Report only	Report only	Report only
Voids filled with asphalt (%) ⁱ				California Test 367	65.0–75.0	65.0–75.0	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) ⁱ				California Test 367				
No. 4 grading								
3/8" grading								
1/2" grading								
3/4" grading					17.0	17.0	--	--
					15.0	15.0	--	
					14.0	14.0	18.0–23.0	
					13.0	13.0	18.0–23.0	
Dust proportion ⁱ				California			Report only	--

No. 4 and 3/8" gradings 1/2" and 3/4" gradings	Test 367	0.6-1.2 0.6-1.2	0.6-1.2 0.6-1.2		
Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) ^j PG-58 PG-64 PG-70 PG-76 or higher	AASHTO T 324 (Modified)	10,000 15,000 20,000 25,000	10,000 15,000 20,000 25,000	--	--
Hamburg wheel track (inflection point minimum number of passes) ^j PG-58 PG-64 PG-70 PG-76 or higher	AASHTO T 324 (Modified)	10,000 10,000 12,500 15000	10,000 10,000 12,500 15000	--	--
Moisture susceptibility (minimum dry strength, psi) ^j	California Test 371	120	120	--	--
Moisture susceptibility (tensile strength ration, %) ^j	California Test 371	70	70	--	--
Smoothness	Section 39-1.12	12-foot straight- edge, must grind, and PI ₀	12-foot straight- edge, must grind, and PI ₀	12-foot straight- edge, must grind, and PI ₀	12-foot straight- edge and must grind
Asphalt binder	Various	Section 92	Section 92	Section 92	Section 92
Asphalt rubber binder	Various	--	--	Section 92- 1.01D(2) and section 39-1.02D	Section 92-1.01D(2) and section 39-1.02D
Asphalt modifier	Various	--	--	Section 39-1.02D	Section 39-1.02D
CRM	Various	--	--	Section 39-1.02D	Section 39-1.02D

^a The Engineer determines combined aggregate gradations containing RAP under California Test 367.

^b "X" denotes the sieves the Engineer tests for the specified aggregate gradation.

^c The tolerances must comply with the allowable tolerances in section 39-1.02E.

^d The Engineer reports the average of 3 tests from a single split sample.

^e The Engineer determines field compaction for any of the following conditions:

1. 1/2-inch, 3/8-inch, or no. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot.
2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

^f To determine field compaction, the Engineer uses:

1. California Test 308, Method A, to determine in-place density of each density core.
2. California Test 309 to determine the maximum theoretical density at the frequency specified in California Test 375, Part 5C.

^g 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.

^h The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

ⁱ Report only.

^j Applies to RAP substitution rate greater than 15 percent.

Replace the 5th paragraph of section 39-2.03A with:

01-20-12

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 if any of the following applies:

1. 1/2-inch, 3/8-inch, or no. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot and any layer is less than 0.15 foot.
2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.2 foot and any layer is less than 0.20 foot.

Replace the 1st paragraph of section 39-3.02A with:

02-22-13

The Department samples for acceptance testing and tests for the quality characteristics shown in the following table:

HMA Acceptance—Method Construction Process

Quality characteristic	Test method	HMA type			
		A	B	RHMA-G	OGFC
Aggregate gradation ^a	California Test 202	JMF ± tolerance ^b			
Sand equivalent (min) ^c	California Test 217	47	42	47	--
Asphalt binder content (%)	California Test 379 or 382	JMF±0.40	JMF±0.40	JMF ± 0.40	JMF ± 0.40
HMA moisture content (% max)	California Test 226 or 370	1.0	1.0	1.0	1.0
Stabilometer value (min) ^c No. 4 and 3/8" gradings 1/2" and 3/4" gradings	California Test 366	30	30	--	--
		37	35	23	--
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	California Test 205	90	25	--	90
		75	--	90	75
		70	20	70	90
Los Angeles Rattler (% max) Loss at 100 rev. Loss at 500 rev.	California Test 211	12	--	12	12
		45	50	40	40
Air void content (%) ^{c, d}	California Test 367	4 ± 2	4 ± 2	TV ± 2	--
Fine aggregate angularity (% min) ^e	California Test 234	45	45	45	--
Flat and elongated particles (% max by weight @ 5:1)	California Test 235	Report only	Report only	Report only	Report only
Voids filled with asphalt (%) ^f No. 4 grading 3/8" grading 1/2" grading 3/4" grading	California Test 367	65.0–75.0	65.0–75.0	Report only	--
		65.0–75.0	65.0–75.0		
		65.0–75.0	65.0–75.0		
		65.0–75.0	65.0–75.0		
Voids in mineral aggregate (% min) ^f No. 4 grading 3/8" grading 1/2" grading 3/4" grading	California Test 367	17.0	17.0	--	--
		15.0	15.0	--	
		14.0	14.0	18.0–23.0	
		13.0	13.0	18.0–23.0	
Dust proportion ^g No. 4 and 3/8" gradings 1/2" and 3/4" gradings	California Test 367	0.6–1.2	0.6–1.2	Report only	--
		0.6–1.2	0.6–1.2		
Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) ^g PG-58 PG-64	AASHTO T 324 (Modified)	10,000	10,000	--	--
		15,000	15,000		

PG-70 PG-76 or higher		20,000 25,000	20,000 25,000		
Hamburg wheel track (inflection point minimum number of passes) ^g PG-58 PG-64 PG-70 PG-76 or higher	AASHTO T 324 (Modified)	10,000 10,000 12,500 15000	10,000 10,000 12,500 15000	--	--
Moisture susceptibility (minimum dry strength, psi) ^g	California Test 371	120	120	--	--
Moisture susceptibility (tensile strength ration, %) ^g	California Test 371	70	70	--	--
Smoothness	Section 39-1.12	12-foot straight- edge and must-grind	12-foot straight- edge and must-grind	12-foot straight- edge and must-grind	12-foot straight- edge and must-grind
Asphalt binder	Various	Section 92	Section 92	Section 92	Section 92
Asphalt rubber binder	Various	--	--	Section 92- 1.01D(2) and section 39-1.02D	Section 92- 1.01D(2) and section 39-1.02D
Asphalt modifier	Various	--	--	Section 39-1.02D	Section 39-1.02D
CRM	Various	--	--	Section 39-1.02D	Section 39-1.02D

^a The Engineer determines combined aggregate gradations containing RAP under California Test 367.

^b The tolerances must comply with the allowable tolerances in section 39-1.02E.

^c The Engineer reports the average of 3 tests from a single split sample.

^d 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.

^e The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

^f Report only.

^g Applies to RAP substitution rate greater than 15 percent.

Replace "280 degrees F" in item 2 in the list in the 6th paragraph of section 39-3.04 with:

01-20-12

285 degrees F

Replace "5,000" in the 5th paragraph of section 39-4.02C with:

02-22-13

10,000

Replace the 7th paragraph of section 39-4.02C with:

02-22-13

Except for RAP substitution rate of greater than 15 percent, the Department does not use results from California Test 371 to determine specification compliance.

Replace the 8th paragraph of section 39-4.02C with:

02-22-13

Comply with the values for the HMA quality characteristics and minimum random sampling and testing for quality control shown in the following table:

Minimum Quality Control—QC/QA Construction Process

Quality characteristic	Test method	Minimum sampling and testing frequency	HMA Type			Location of sampling	Maximum report-ing time allow-ance
			A	B	RHMA-G		
Aggregate gradation ^a	California Test 202	1 per 750 tons	JMF ± tolerance ^b	JMF ± tolerance ^b	JMF ± tolerance ^b	California Test 125	24 hours
Asphalt binder content (%)	California Test 379 or 382		JMF±0.40	JMF±0.40	JMF ±0.40	Loose mix behind paver See California Test 125	
Field compaction (% max. theoretical density) ^{c,d}	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 ^e	California Test 226 or 370	2 per day during production	--	--	--	Stock-piles or cold feed belts	--
Sand equivalent (min) ^f	California Test 217	1 per 750 tons	47	42	47	California Test 125	24 hours
HMA moisture content (% max)	California Test 226 or 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 California Test 125	24 hours
Stabilometer value (min) ^f	California Test 366	1 per 4,000 tons or 2 per 5 business days, whichever is greater	30	30	--		48 hours
No. 4 and 3/8" gradings 1/2" and 3/4" gradings			37	35	23		
Air void content (%) ^{f,g}	California Test 367		4 ± 2	4 ± 2	TV ± 2		

Percent of crushed particles coarse aggregate (% min.): One fractured face Two fractured faces	California Test 205	As designated in QC plan. At least once per project.	90	25	--	California Test 125	48 hours
			75	--	90		
Fine aggregate (% min) (Passing no. 4 sieve and retained on no. 8 sieve): One fractured face			70	20	70		
Los Angeles Rattler (% max): Loss at 100 rev. Loss at 500 rev.	California Test 211		12	--	12	California Test 125	
			45	50	40		
Fine aggregate angularity (% min) ⁿ	California Test 234		45	45	45	California Test 125	
Flat and elongated particle (% max by weight @ 5:1)	California Test 235		Report only	Report only	Report only	California Test 125	
Voids filled with asphalt (%) ⁱ No. 4 grading 3/8" grading 1/2" grading 3/4" grading	California Test 367				Report only		
			65.0–75.0	65.0–75.0			
		65.0–75.0	65.0–75.0				
		65.0–75.0	65.0–75.0				
		65.0–75.0	65.0–75.0				
Voids in mineral aggregate (% min.) ⁱ No. 4 grading 3/8" grading 1/2" grading 3/4" grading	California Test 367						
		17.0	17.0	--			
		15.0	15.0	--			
		14.0	14.0	18.0–23.0			
		13.0	13.0	18.0–23.0			

Dust proportion ⁱ No. 4 and 3/8" gradings 1/2" and 3/4" gradings	California Test 367		0.6–1.2 0.6–1.2	0.6–1.2 0.6–1.2	Report only		
Hamburg wheel track (minimum number of passes at 0.5 inch average rut depth) ⁱ PG-58 PG-64 PG-70 PG-76 or higher	AASHTO T 324 (Modified)	1 per 10,000 tons or 1 per project whichever is greater	10,000 15,000 20,000 25,000	10,000 15,000 20,000 25,000	--	--	
Hamburg wheel track (inflection point minimum number of passes) ⁱ PG-58 PG-64 PG-70 PG-76 or higher	AASHTO T 324 (Modified)	1 per 10,000 tons or 1 per project whichever is greater	10,000 10,000 12,500 15000	10,000 10,000 12,500 15000	--	--	
Moisture susceptibility (minimum dry strength, psi) ⁱ	California Test 371	1 per 10,000 tons or 1 per project whichever is greater	120	120	--	--	
Moisture susceptibility (tensile strength ratio, %) ^j	California Test 371	1 per 10,000 tons or 1 per project whichever is greater	70	70	70	--	
Smoothness	Section 39-1.12	--	12-foot straight-edge, must-grind, and P ₁₀	12-foot straight-edge, must-grind, and P ₁₀	12-foot straight-edge, must-grind, and P ₁₀	--	
Asphalt rubber binder viscosity @ 375 °F, centipoises	Section 39-1.02D	--	--	--	1,500–4,000	Section 39-1.02D	24 hours
CRM	Section 39-1.02D	--	--	--	Section 39-1.02D	Section 39-1.02D	48 hours

- ^a Determine combined aggregate gradation containing RAP under California Test 367.
- ^b The tolerances must comply with the allowable tolerances in section 39-1.02E.
- ^c Determines field compaction for any of the following conditions:
 1. 1/2-inch, 3/8-inch, or no. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot.
 2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.
- ^d To determine field compaction use:
 1. In-place density measurements using the method specified in your QC plan.
 2. California Test 309 to determine the maximum theoretical density at the frequency specified in California Test 375, Part 5C.
- ^e For adjusting the plant controller at the HMA plant.
- ^f Report the average of 3 tests from a single split sample.
- ^g 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.
- ^h The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.
- ⁱ Report only.
- ^j Applies to RAP substitution rate greater than 15 percent.

Replace the 1st sentence in the 1st paragraph of section 39-4.03B(2) with:

01-20-12

For aggregate gradation and asphalt binder content, the minimum ratio of verification testing frequency to quality control testing frequency is 1:5.

Replace the 2nd "and" in the 7th paragraph of section 39-4.03B(2) with:

01-20-12

or

Replace the 1st paragraph of section 39-4.04A with:

02-22-13

The Engineer samples for acceptance testing and tests for the following quality characteristics:

HMA Acceptance—QC/QA Construction Process

Index (i)	Quality characteristic				Weight -ing factor (w)	Test method	HMA type		
							A	B	RHMA-G
		Aggregate gradation ^a				California Test 202	JMF ± Tolerance ^c		
	Sieve	3/4"	1/2"	3/8"					
1	1/2"	X ^b	--	--	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	California Test 379 or 382	JMF±0.40	JMF±0.40	JMF ± 0.40
5	Field compaction (% max. theoretical density) ^{d, e}				0.40	California Test 375	92–96	92–96	91–96
	Sand equivalent (min) ^f					California Test 217	47	42	47
	Stabilometer value (min) ^f No. 4 and 3/8" gradings 1/2" and 3/4" gradings					California Test 366	30 37	30 35	-- 23
	Air void content (%) ^{f, g}					California Test 367	4 ± 2	4 ± 2	TV ± 2
	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					California Test 205	90 75	25 --	-- 90
	HMA moisture content (% max)					California Test 226 or 370	1.0	1.0	1.0
	Los Angeles Rattler (% max) Loss at 100 rev. Loss at 500 rev.					California Test 211	12 45	-- 50	12 40
	Fine aggregate angularity (% min) ^h					California Test 234	45	45	45
	Flat and elongated particle (% max by weight @ 5:1)					California Test 235	Report only	Report only	Report only
	Voids in mineral aggregate (% min) ⁱ No. 4 grading 3/8" grading 1/2" grading 3/4" grading					California Test 367	17.0 15.0 14.0 13.0	17.0 15.0 14.0 13.0	-- -- 18.0–23.0 18.0–23.0

	Voids filled with asphalt (%) ⁱ No. 4 grading 3/8" grading 1/2" grading 3/4" grading		California Test 367	65.0–75.0 65.0–75.0 65.0–75.0 65.0–75.0	65.0–75.0 65.0–75.0 65.0–75.0 65.0–75.0	Report only
	Dust proportion ¹ No. 4 and 3/8" gradings 1/2" and 3/4" gradings		California Test 367	0.6–1.2 0.6–1.2	0.6–1.2 0.6–1.2	Report only
	Hamburg Wheel Tracker (minimum number of passes at 0.5 inch average rut depth) ^j PG-58 PG-64 PG-70 PG-76 or higher		AASHTO T 324 (Modified)	10,000 15,000 20,000 25,000	10,000 15,000 20,000 25,000	--
	Hamburg Wheel Tracker (inflection point minimum number of passes) ^j PG-58 PG-64 PG-70 PG-76 or higher		AASHTO T 324 (Modified)	10,000 15,000 20,000 25,000	10,000 15,000 20,000 25,000	--
	Moisture susceptibility (minimum dry strength, psi) ^j		California Test 371	120	120	--
	Moisture susceptibility (tensile strength ratio %) ^j		California Test 371	70	70	70
	Smoothness		Section 39-1.12	12-foot straight- edge, must grind, and PI ₀	12-foot straight- edge, must grind, and PI ₀	12-foot straight- edge, must grind, and PI ₀
	Asphalt binder		Various	Section 92	Section 92	Section 92
	Asphalt rubber binder		Various	--	--	Section 92-1.01D(2) and section 39-1.02D
	Asphalt modifier		Various	--	--	Section 39-1.02D
	CRM		Various	--	--	Section 39-1.02D

suspension limit: Value at which production must be suspended while corrections are made.

40-1.01C Submittals

40-1.01C(1) General

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. Joint filler

As an informational submittal, submit calibration documentation and operational guidelines for frequency measuring devices (tachometer) for concrete consolidation vibrators.

Submit updated quality control charts each paving day.

40-1.01C(2) Certificates of Compliance

Submit a certificate of compliance for:

1. Tie bars
2. Threaded tie bar splice couplers
3. Dowel bars
4. Tie bar baskets
5. Dowel bar baskets
6. Joint filler
7. Epoxy powder coating

40-1.01C(3) Quality Control Plan

Submit a concrete pavement QC plan. Allow 30 days for review.

40-1.01C(4) Mix Design

At least 15 days before testing for mix proportions, submit a copy of the AASHTO accreditation for your laboratory determining the mix proportions. At least 15 days before starting field qualification, submit 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.

40-1.01C(5) 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. The minimum batch size is 5 cu yd.
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.

40-1.01C(6) Cores

Submit for authorization the name of the laboratory you propose to use for testing the cores for air content.

Submit each core in an individual plastic bag marked with a location description.

40-1.01C(7) Profile Data and Straightedge Measurements

At least 5 business days before start of initial profiling or changing profiler or operator, submit:

1. Inertial profiler (IP) certification issued by the Department. The certification must not be more than 12 months old.

2. Operator certification for the IP issued by the Department. The operator must be certified for each different model of IP device operated. The certification must not be more than 12 months old.
3. List of manufacturer's recommended test procedures for IP calibration and verification.

Within 2 business days after cross correlation testing, submit ProVAL profiler certification analysis report for cross correlation test results performed on test section. ProVAL is FHWA's software. Submit the certification analysis report to the Engineer and to the electronic mailbox address:

smoothness@dot.ca.gov

Within 2 business days after each day of inertial profiling, submit profile data to the Engineer and to the electronic mailbox address:

smoothness@dot.ca.gov

Within 2 business days of performing straightedge testing, submit a report of areas requiring smoothness correction.

40-1.01C(8)–40-1.01C(12) Reserved

40-1.01D Quality Control and Assurance

40-1.01D(1) General

If the pavement quantity is at least 2000 cu yd, provide a QC manager.

Core pavement as described for, thickness, bar placement, and air content.

For the Department's modulus of rupture testing, assist the Engineer in fabricating test beams by providing materials and labor.

Allow at least 25 days for the Department to schedule testing for coefficient of friction. Notify the Engineer when the pavement is scheduled to be opened to traffic. Notify the Engineer when the pavement is ready for testing which is the latter of:

1. Seven days after paving
2. When the pavement has attained a modulus of rupture of at least 550 psi

The Department tests for coefficient of friction within 7 days of receiving notification that the pavement is ready for testing.

40-1.01D(2) Prepaving Conference

Schedule a prepaving conference at a mutually agreed upon time and place to meet with the Engineer. Make the arrangements for the conference facility. Discuss QC plan and methods of performing each item of the 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. QC manager
3. Paving construction foreman
4. Workers and your subcontractor's workers, including:
 - 4.1. Foremen including subcontractor's Foremen
 - 4.2. Concrete plant manager
 - 4.3. Concrete plant operator

Do not start paving activities including test strips until the listed personnel have attended a prepaving conference.

40-1.01D(3) Just-In-Time-Training

Reserved

40-1.01D(4) Quality Control Plan

Establish, implement, and maintain a QC plan for pavement. The QC plan must describe the organization and procedures used to:

1. Control the production process
2. Determine if a change to the production process is needed
3. Implement a change

The QC plan must include action and suspension limits and details of corrective action to be taken if any process is out of those limits. Suspension limits must not exceed specified acceptance criteria.

The QC plan 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. Bar reinforcement placement and alignment
11. Dowel bar placement, alignment, and anchorage
12. Tie bar placement
13. Modulus of rupture
14. Finishing and curing
15. Protecting pavement
16. Surface smoothness

40-1.01D(5) Mix Design

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

Make trial mixtures no more than 24 months before field qualification.

Using your trial mixtures, determine the minimum cementitious materials content. Use your value for minimum cementitious material content for *MC* in equation 1 and equation 2 of section 90-1.02B(3).

To determine the minimum cementitious materials content or maximum water to cementitious materials ratio, use modulus of rupture values of at least 570 psi for 28 days age and at least 650 psi for 42 days age.

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.

40-1.01D(6) Quality Control Testing

40-1.01D(6)(a) General

Testing laboratories and testing equipment must comply with the Department's Independent Assurance Program.

40-1.01D(6)(b) Concrete Mix

Before placing pavement, your mix design must be field qualified. Use an ACI certified "Concrete Laboratory Technician, Grade I" to perform field qualification tests and calculations. Test for modulus of rupture under California Test 523 at 10, 21, and 28 days of age.

When placing pavement, your quality control must include testing properties at the frequencies shown in the following table:

QC Testing Frequency

Property	Test method	Minimum frequency
Cleanness value	California Test 227	2 per day
Sand equivalent	California Test 217	2 per day
Aggregate gradation	California Test 202	2 per day
Air content (air entrainment specified)	California Test 504	1 per hour
Air content (air entrainment not specified)	California Test 504	1 per 4 hours
Density	California Test 518	1 per 4 hours
Penetration	California Test 533	1 per 4 hours
Aggregate moisture meter calibration ^a	California Test 223 or California Test 226	1 per day

^a Check calibration of the plant moisture meter by comparing moisture meter readings with California Test 223 or California Test 226 test results.

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 air content control charts, the action limit is ± 1.0 percent of the specified value. If no value is specified, the action limit is ± 1.0 percent of the value used for your approved mix design.

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 individual penetration or air content measurements:
 - 2.1. One point falls outside the suspension limit line
 - 2.2. Two points in a row fall outside the action limit line

Stop production and take corrective action for out of control processes or the Engineer rejects subsequent material.

Before each day's concrete pavement placement and at intervals not to exceed 4 hours of production, use a tachometer to test and record vibration frequency for concrete consolidation vibrators.

40-1.01D(6)(c) Pavement Smoothness

40-1.01D(6)(c)(i) General

Notify the Engineer 2 business days before performing smoothness testing including IP calibration and verification testing. The notification must include start time and locations by station.

Before testing the pavement smoothness, remove foreign objects from the surface, and mark the beginning and ending station on the pavement shoulder.

Test pavement smoothness using an IP except use a 12-foot straightedge at the following locations:

1. Traffic lanes less than 1,000 feet in length including ramps, turn lanes, and acceleration and deceleration lanes
2. Areas within 15 feet of manholes
3. Shoulders
4. Weigh-in-motion areas
5. Miscellaneous areas such as medians, gore areas, turnouts, and maintenance pullouts

40-1.01D(6)(c)(ii) Straightedge Testing

Identify locations of areas requiring correction by:

1. Location Number
2. District-County-Route
3. Beginning station or post mile to the nearest 0.01 mile
4. For correction areas within a lane:
 - 4.1. Lane direction as NB, SB, EB, or WB
 - 4.2. Lane number from left to right in direction of travel
 - 4.3. Wheel path as "L" for left, "R" for right, or "B" for both
5. For correction areas not within a lane:
 - 5.1. Identify pavement area (e.g., shoulder, weight station, turnout)
 - 5.2. Direction and distance from centerline as "L" for left or "R" for right
6. Estimated size of correction area

40-1.01D(6)(c)(iii) Inertial Profile Testing

IP equipment must display a current certification decal with expiration date.

Conduct cross correlation IP verification test in the Engineer's presence before performing initial profiling. Verify cross correlation IP verification test at least annually. Conduct 5 repeat runs of the IP on an authorized test section. The test section must be on an existing concrete pavement surface 0.1 mile long. Calculate a cross correlation to determine the repeatability of your device under Section 8.3.1.2 of AASHTO R 56 using ProVAL profiler certification analysis with a 3 feet maximum offset. The cross correlation must be a minimum of 0.92.

Conduct the following IP calibration and verification tests in the Engineer's presence each day before performing inertial profiling:

1. Block test. Verify the height sensor accuracy under AASHTO R 57, section 5.3.2.3.
2. Bounce test. Verify the combined height sensor and accelerometer accuracy under AASHTO R 57, section 5.3.2.3.2.
3. DMI test. Calibrate the accuracy of the testing procedure under AASHTO R 56, section 8.4.
4. Manufacturer's recommended tests.

Collect IP data using the specified ProVAL analysis with 250 mm and IRI filters. Comply with the requirements for data collection under AASHTO R 56.

For IP testing, wheel paths are 3 feet from and parallel to the edge of a lane. Left and right are relative to the direction of travel. The IRI is the pavement smoothness along a wheel path of a given lane. The MRI is the average of the IRI values for the left and right wheel path from the same lane.

Operate the IP according to the manufacturer's recommendations and AASHTO R 57 at 1-inch recording intervals and a minimum 4 inch line laser sensor.

Collect IP data under AASHTO R 56. IP data must include:

1. Raw profile data for each lane.
2. ProVAL ride quality analysis report for the international roughness index (IRI) of left and right wheel paths of each lane. Submit in pdf file format.
3. ProVAL ride quality analysis report for the mean roughness index (MRI) of each lane. Submit in pdf file format.
4. ProVAL smoothness assurance analysis report for IRIs of left wheel path. Submit in pdf file format.
5. ProVAL smoothness assurance analysis report for IRIs of right wheel path. Submit in pdf file format.
6. GPS data file for each lane in GPS exchange. Submit in GPS eXchange file format.
7. Manufacturer's recommended IP calibration and verification tests results.
8. AASHTO IP calibration and verification test results including bounce, block, and distance measurement instrument (DMI).

Submit the IP raw profile data in unfiltered electronic pavement profile file (PPF) format. Name the PPF file using the following naming convention:

YYYYMMDD_TTCCRRR_D_L_W_S_X_PT.PPF

where:

YYYY = year

MM = Month, leading zero

DD = Day of month, leading zero

TT = District, leading zero

CCC = County, 2 or 3 letter abbreviation as shown in section 1-1.08

RRR = Route number, no leading zeros

D = Traffic direction as NB, SB, WB, or EB

L = Lane number from left to right in direction of travel

W = Wheel path as "L" for left, "R" for right, or "B" for both

S = Beginning station to the nearest foot (e.g., 10+20) or beginning post mile to the nearest hundredth (e.g., 25.06) no leading zero

X = Profile operation as "EXIST" for existing pavement, "PAVE" for after paving, or "CORR" for after final surface pavement correction

PT = Pavement type (e.g., "concrete", etc.)

Determine IRIs using the ProVAL ride quality analysis with a 250 mm and IRI filters. While collecting the profile data to determine IRI, record the following locations in the raw profile data:

1. Begin and end of all bridge approach slabs
2. Begin and end of all bridges
3. Begin and end of all culverts visible on the roadway surface

For each 0.1 mile section, your IRI values must be within 10 percent of the Department's IRI values. The Engineer may order you to recalibrate your IP equipment and reprofile. If your results are inaccurate due to operator error, the Engineer may disqualify your IP operator.

Determine the MRI for 0.1-mile fixed sections. A partial section less than 0.1 mile that is the result of an interruption to continuous pavement surface must comply with the MRI specifications for a full section. Adjust the MRI for a partial section to reflect a full section based on the proportion of a section paved.

Determine the areas of localized roughness. Use the ProVAL smoothness assurance with a continuous IRI for each wheel path, 25-foot interval, and 250 mm and IRI filters.

40-1.01D(6)(c)(iv) Reserved

40-1.01D(6)(d)–40-1.01D(6)(h) Reserved

40-1.01D(7) Pavement Acceptance

40-1.01D(7)(a) Acceptance Testing

40-1.01D(7)(a)(i) General

The Department's acceptance testing includes testing the pavement properties at the minimum frequencies shown in the following table:

Property	Test Method		Frequency ^a
	CRCP	JPCP	
Modulus of rupture (28 day)	California Test 523		1,000 cu yd
Air content ^b	California Test 504		1 day's paving
Dowel bar placement	--	Measurement ^a	700 sq yd
Tie bar placement	--	Measurement ^a	4,000 sq yd
Thickness	California Test 531		1,200 sq yd
Coefficient of friction	California Test 342		1 day's paving

^aA single test represents no more than the frequency specified.

^bTested only when air entrainment is specified.

Pavement smoothness may be accepted based on your testing in the absence of the Department's testing.

40-1.01D(7)(a)(ii) Air Content

If air-entraining admixtures are specified, the Engineer uses a t-test to compare your QC test results with the Department's test results. The t-value for test data is determined using the following equation:

where:

- n_c = Number of your quality control tests (minimum of 6 required)
- n_v = Number of Department's tests (minimum of 2 required)
- \bar{X}_c = Mean of your quality control tests
- \bar{X}_v = Mean of the Department's 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 Department's tests (when $n_v > 1$)

The Engineer compares your QC test results with the Department's test results at a level of significance of $\alpha = 0.01$. The Engineer compares the t-value to t_{crit} , using degrees of freedom showing in the following table:

degrees of freedom (nc+nv-2)	tcrit (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 tcrit, your quality control test results are verified. If the t-value calculated is greater than tcrit, 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 40-1.03P. The Engineer selects the core locations. The authorized 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 by the authorized laboratory under ASTM C 457 for acceptance.

40-1.01D(7)(a)(iii) Dowel and Tie Bar Placement

For JPCP, drill cores under section 40-1.03P for the Department's acceptance testing.

The Engineer identifies which joint and dowel or tie bar are to be tested. Core each day's paving within 2 business days. Each dowel or tie bar test consists of 2 cores, 1 on each bar end to expose both ends and allow measurement.

If the tests indicate dowel or tie bars are not placed within the specified tolerances or if there is unconsolidated concrete around the dowel or tie bars, core additional specimens identified by Engineer to determine the limits of unacceptable work.

40-1.01D(7)(a)(iv) Thickness

Drill cores under section 40-1.03P for the Department's acceptance testing in the primary area, which is the area placed in 1 day for each thickness. Core at locations determined by the Engineer and in the Engineer's presence.

Do not core until any grinding has been completed.

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. 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 by the areas bound by longitudinal and transverse joints and concrete pavement edges. Slabs with bar reinforcement are defined by 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.

40-1.01D(7)(a)(v)–40-1.01D(7)(a)(ix) Reserved

40-1.01D(7)(b) Acceptance Criteria

40-1.01D(7)(b)(i) General

Reserved

40-1.01D(7)(b)(ii) Modulus of Rupture

For field qualification, the modulus of rupture at no later than 28 days must be at least:

1. 550 psi for each single beam
2. 570 psi for the average of 5 beams

For production, the modulus of rupture for the average of the individual test results of 2 beams aged for 28 days must be at least 570 psi.

40-1.01D(7)(b)(iii) Air Content

The air content must be within ± 1.5 percent of the specified value. If no value is specified, the air content must be within ± 1.5 percent of, the value used for your approved mix design.

40-1.01D(7)(b)(iv) Bar Reinforcement

In addition to requirements of Section 52, bar reinforcement must be more than 1/2 inch below the saw cut depth at concrete pavement joints.

40-1.01D(7)(b)(v) Dowel Bar and Tie Bar Placement

Tie bar placement must comply with the tolerances shown in the following table:

Tie Bar Tolerance	
Dimension	Tolerance
Horizontal and vertical skew	5 1/4 inch, max
Longitudinal translation	± 2 inch
Horizontal offset (embedment)	± 2 inch
Vertical depth	<ol style="list-style-type: none"> 1. At least 1/2 inch below the bottom of the saw cut 2. When measured at any point along the bar, not less than 2 inches clear of the pavement's surface and bottom

NOTE: Tolerances are measured relative to the completed joint.

Dowel bar placement must comply with the tolerances shown in the following table:

Dowel Bar Tolerances

Dimension	Tolerance
Horizontal offset	±1 inch
Longitudinal translation	±2 inch
Horizontal skew	5/8 inch, max
Vertical skew	5/8 inch, max
Vertical depth	<p>The minimum distance measured from concrete pavement surface to any point along the top of dowel bar must be: DB + 1/2 inch</p> <p>where: DB = one third of pavement thickness in inches, or the saw cut depth, whichever is greater</p> <p>The maximum distance below the depth shown must be 5/8 inch.</p>

NOTE: Tolerances are measured relative to the completed joint.

The Engineer determines the limits for removal and replacement.

40-1.01D(7)(b)(vi) Pavement Thickness

Concrete pavement thickness must not be deficient by more than 0.05 foot.

The minimum thickness is not reduced for specifications that may affect concrete pavement thickness such as allowable tolerances for subgrade construction.

The Engineer determines the areas of noncompliant pavement, the thickness deficiencies, and the limits where removal is required.

Pavement with an average thickness deficiency less than 0.01 foot is acceptable. If the thickness deficiency is 0.01 foot or more and less than 0.05 foot, you may request authorization to leave the pavement in place and accept a pay adjustment. If the deficiency is more than 0.05 foot the pavement must be removed and replaced.

40-1.01D(7)(b)(vii) Pavement Smoothness

Where testing with an IP is required, the pavement surface must have:

1. No areas of localized roughness with an IRI greater than 120 in/mi
2. MRI of 60 in/mi or less within a 0.1 mile section

Where testing with a straightedge is required, the pavement surface must not vary from the lower edge of the straightedge by more than:

1. 0.01 foot when the straightedge is laid parallel with the centerline
2. 0.02 foot when the straightedge is laid perpendicular to the centerline and extends from edge to edge of a traffic lane
3. 0.02 foot when the straightedge is laid within 24 feet of a pavement conform

40-1.01D(7)(b)(viii) Coefficient of Friction

Initial and final texturing must produce a coefficient of friction of at least 0.30. Do not open the pavement to traffic unless the coefficient of friction is at least 0.30.

40-1.01D(7)(b)(ix)–40-1.01D(7)(b)(xii) Reserved

40-1.02 MATERIALS

40-1.02A General

Water for coring must comply with section 90.

Tack coat must comply with section 39.

40-1.02B Concrete

40-1.02B(1) General

PCC for pavement must comply with section 90-1 except as otherwise specified.

40-1.02B(2) Cementitious Material

Concrete must contain from 505 pounds to 675 pounds cementitious material per cubic yard. The specifications for reducing cementitious material content in section 90-1.02E(2) do not apply .

40-1.02B(3) Aggregate

Aggregate must comply with section 90-1.02C except the specifications for reduction in operating range and contract compliance for cleanness value and sand equivalent specified in section 90-1.02C(2) and section 90-1.02C(3) do not apply.

For coarse aggregate in high desert and high mountain climate regions, the loss must not exceed 25 percent when tested under California Test 211 with 500 revolutions.

For combined aggregate gradings, 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.

40-1.02B(4) Air Entrainment

The second paragraph of section 90-1.02I(2)(a) does not apply.

For a project shown in the low and south mountain climate regions, add air-entraining admixture to the concrete at the rate required to produce an air content of 4 percent in the freshly mixed concrete.

For a project shown in the high desert and high mountain climate regions, add air-entraining admixture to the concrete at the rate required to produce an air content of 6 percent in the freshly mixed concrete.

40-1.02B(5)–40-1.02B(8) Reserved

40-1.02C Reinforcement, Bars, and Baskets

40-1.02C(1) Bar Reinforcement

Bar reinforcement must be deformed bars.

If the project is not shown to be in high desert or any mountain climate region, bar reinforcement must comply with section 52.

If the project is shown to be in high desert or any mountain climate regions, bar reinforcement must be one of the following:

1. Epoxy-coated bar reinforcement under section 52-2.03B except bars must comply with either ASTM A 706/A 706M; ASTM A 996/A 996M; or ASTM A 615/A 615M, Grade 40 or 60. Bars must be handled under ASTM D 3963/D 3963M and section 52-2.02C.
2. Low carbon, chromium steel bar complying with ASTM A 1035/A 1035M

40-1.02C(2) Dowel Bars

Dowel bars must be plain bars. Fabricate, sample, and handle epoxy-coated dowel bars under ASTM D 3963/D 3963M and section 52-2.03C except each sample must be 18 inches long.

If the project is not shown to be in high desert or any mountain climate region, dowel bars must be one of the following:

1. Epoxy-coated bars. Bars must comply with ASTM A 615/A 615M, Grade 40 or 60. Epoxy coating must comply with either section 52-2.02B or 52-2.03B.

2. Stainless-steel bars. Bars must be descaled solid stainless-steel bars under ASTM A 955/A 955M, UNS Designation S31603 or S31803.
3. Low carbon, chromium-steel bars under ASTM A 1035/A 1035M.

If the project is shown to be in high desert or any mountain climate region, dowel bars must be one of the following:

1. Epoxy-coated bars. Bars must comply with ASTM A 615/A 615M, Grade 40 or 60. Epoxy coating must comply with section 52-2.03B.
2. Stainless-steel bars. Bars must be descaled solid stainless-steel bars under ASTM A 955/A 955M, UNS Designation S31603 or S31803.

40-1.02C(3) Tie Bars

Tie bars must be deformed bars.

If the project is not shown to be in high desert or any mountain climate region, tie bars must be one of the following:

1. Epoxy-coated bar reinforcement. Bars must comply with either section 52-2.02B or 52-2.03B except bars must comply with either ASTM A 706/A 706M; ASTM A 996/A 996M; or ASTM A 615/A 615M, Grade 40 or 60.
2. Stainless-steel bars. Bars must be descaled solid stainless-steel bars under ASTM A 955/A 955M, UNS Designation S31603 or S31803.
3. Low carbon, chromium-steel bars under ASTM A 1035/A 1035M.

If the project is shown to be in high desert or any mountain climate region, tie bars must be one of the following:

1. Epoxy-coated bar reinforcement. Bars must comply with section 52-2.03B except bars must comply with either ASTM A 706/A 706M; ASTM A 996/A 996M; or ASTM A 615/A 615M, Grade 40 or 60.
2. Stainless-steel bars. Bars must be descaled solid stainless-steel bars under ASTM A 955/A 955M, UNS Designation S31603 or S31803.

Fabricate, sample, and handle epoxy-coated tie bars under ASTM D 3963/D 3963M, section 52-2.02, or section 52-2.03.

Do not bend tie bars.

40-1.02C(4) Dowel and Tie Bar Baskets

For dowel and tie bar baskets, wire must comply with ASTM A 82/A 82M and be welded under ASTM A 185/A 185M, Section 7.4. The minimum wire-size no. is W10. Use either U-frame or A-frame shaped assemblies.

If the project is not shown to be in high desert or any mountain climate region, baskets may be epoxy-coated, and the epoxy coating must comply with either section 52-2.02B or 52-2.03B.

If the project is shown to be in high desert or any mountain climate region, wire for dowel bar and tie bar baskets must be one of the following:

1. Epoxy-coated wire complying with section 52-2.03B
2. Stainless-steel wire. Wire must be descaled solid stainless-steel. Wire must comply with (1) the chemical requirements in ASTM A 276/A 276M, UNS Designation S31603 or S31803 and (2) the tension requirements in ASTM A 1022/ A 1022M.

Handle epoxy-coated tie bar and dowel bar baskets under ASTM D 3963/D 3963M and either section 52-2.02 or 52-2.03.

Fasteners must be driven fasteners under ASTM F 1667. Fasteners on lean concrete base or HMA 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 by either electroplating or galvanizing.

40-1.02D Dowel Bar Lubricant

Dowel bar lubricant must be petroleum paraffin based or a 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 no. 3.

40-1.02E Joint Filler

Joint filler for isolation joint must be preformed expansion joint filler for concrete (bituminous type) under ASTM D 994.

40-1.02F Curing Compound

Curing compound must be curing compound no. 1 or 2.

40-1.02G Nonshrink Hydraulic Cement Grout

Nonshrink hydraulic cement grout must comply with ASTM C 1107/C 1107M. Clean, uniform, rounded aggregate filler may be used 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 when tested under California Test 223 or California Test 226. Aggregate filler tested under California Test 202 must comply with the grading shown in the following table:

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

40-1.02H Temporary Roadway Pavement Structure

Temporary roadway pavement structure must comply with section 41-1.02E.

40-1.02I–40-1.02N Reserved

40-1.03 CONSTRUCTION

40-1.03A General

Aggregate and bulk cementitious material must be proportioned by weight by means of automatic proportioning devices of approved types.

For widenings and lane reconstruction, construct only the portion of pavement where the work will be completed during the same lane closure. If you fail to complete the construction during the same lane closure, construct a temporary pavement structure under section 41-1.

40-1.03B Water Supply

Before placing concrete pavement, develop enough water supply.

40-1.03C Test Strips

Construct a test strip for each type of pavement with a quantity of more than 2,000 cu yd. Obtain authorization of the test strip before constructing pavement. Test strips must be:

1. 700 to 1,000 feet long
2. Same width as the planned paving, and
3. Constructed using the same equipment proposed for paving

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.

Test strips must comply with the acceptance criteria for:

1. Smoothness, except IP is not required
2. Dowel bars and tie bars placement
3. Pavement thickness
4. Final finishing, except the coefficient of friction is not considered

Allow 3 business days for evaluation. If the test strip is noncompliant, stop paving and submit a plan for changed materials, methods, or equipment. Allow 3 business days for authorization of the plan. Construct another test strip per the authorized plan.

Remove and dispose of noncompliant test strips.

If the test strip is compliant except for smoothness and final finishing, you may grind the surface. After grinding retest the test strip smoothness under section 40-1.01D(6)(c).

If the test strip is compliant for smoothness and thickness, construction of an additional test strip is not required and the test strip may remain in place.

Construct additional test strips if you:

1. Propose different paving equipment including:
 - 1.1. Paver
 - 1.2. Dowel bar inserter
 - 1.3. Tie bar inserter
 - 1.4. Tining
 - 1.5. Curing equipment
2. Change concrete mix proportions

You may request authorization to eliminate the test strip if you use paving equipment and personnel from a Department project (1) for the same type of pavement and (2) completed within the past 12 months. Submit supporting documents and previous project information with your request.

40-1.03D Joints

40-1.03D(1) General

Do not bend tie bars or reinforcement in existing concrete pavement joints.

For contraction joints and isolation joints, saw cut a groove with a power-driven saw. After cutting, immediately wash slurry from the joint with water at less than 100 psi pressure.

Keep joints free from foreign material including soil, gravel, concrete, and asphalt. To keep foreign material out of the joint, you may use filler material. Filler material must not react adversely with the concrete or cause concrete pavement damage. After sawing and washing, install filler material that keeps moisture in the adjacent concrete during the 72 hours after paving. If you install filler material, the specifications for spraying the sawed joint with additional curing compound in section 40-1.03K does not apply. If using absorptive filler material, moisten the filler immediately before or after installation.

40-1.03D(2) Construction Joints

Construction joints must be vertical.

Before placing fresh concrete against hardened concrete, existing concrete pavement, or structures, apply curing compound no. 1 or 2 to the vertical surface of the hardened concrete, existing concrete pavement, or structures and allow it to dry.

At joints between concrete pavement and HMA, apply tack coat between the concrete pavement and HMA.

Use a metal or wooden bulkhead to form transverse construction joints. If dowel bars are described, the bulkhead must allow dowel bar installation.

40-1.03D(3) Contraction Joints

Saw contraction joints before cracking occurs and after the concrete is hard enough to saw without spalling, raveling, or tearing.

Saw cut using a power saw with a diamond blade. After cutting, immediately wash slurry from the joint with water at less than 100 psi pressure.

Except for longitudinal joints parallel to a curving centerline, transverse and longitudinal contraction joints must not deviate by more than 0.1 foot from either side of a 12-foot straight line

Cut transverse contraction joints within 0.5 foot of the spacing described. Adjust spacing if needed such that slabs are at least 10 feet long.

For widenings, do not match transverse contraction joints with existing joint spacing or skew unless otherwise described.

Cut transverse contraction joints straight across the full concrete pavement width, between isolation joints and edges of pavement. In areas of converging and diverging pavements, space transverse contraction joints such that the joint is continuous across the maximum pavement width. Longitudinal contraction joints must be parallel with the concrete pavement centerline, except when lanes converge or diverge.

40-1.03D(4) Isolation Joints

Before placing concrete at isolation joints, prepare the existing concrete face and secure joint filler. Prepare by saw cutting and making a clean flat vertical surface. Make the saw cut the same depth as the depth of the new pavement.

40-1.03E Bar Reinforcement

Place bar reinforcement under section 52.

40-1.03F Dowel Bar Placement

If using curing compound as lubricant, apply the curing compound to dowels in 2 separate applications. Lubricate each dowel bar entirely 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.

Install dowel bars using one of the following methods:

1. Drill and bond bars. Comply with section 41-10.
2. Mechanical insertion. Eliminate evidence of the insertion by reworking the concrete over the dowel bars.
3. Dowel bar baskets. Anchor baskets with fasteners. Use at least 1 fastener per foot for basket sections. Baskets must be anchored at least 200 feet in advance of the concrete placement activity unless your waiver request is authorized. 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.

If dowel bars are noncompliant, stop paving activities, demonstrate your correction, and obtain verbal approval from the Engineer.

40-1.03G Tie Bar Placement

Install tie bars at longitudinal joints using one of the following methods:

1. Drill and bond bars. Comply with section 41-10.
2. Insert bars. Mechanically insert tie bars into plastic slip-formed concrete before finishing. Inserted tie bars must have full contact between the bar and the concrete. Eliminate evidence of the insertion by reworking the concrete over the tie bars.
3. Threaded couplers. Threaded tie bar splice couplers must be fabricated from deformed bar reinforcement and free of external welding or machining.
4. Tie bar baskets. Anchor baskets at least 200 feet in advance of pavement 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 paving, demonstrate the tie bars do not move from their specified depth and alignment during paving. Use fasteners to anchor tie bar baskets.

If tie bars are noncompliant, stop paving activities, demonstrate your correction, and obtain verbal approval from the Engineer.

40-1.03H Placing Concrete

40-1.03H(1) General

Immediately prior to placing concrete, the surface to receive concrete must be:

1. In compliance with specified requirements, including compaction and elevation tolerances
2. Free of loose and extraneous material
3. Uniformly moist, but free of standing or flowing water

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).

40-1.03H(2) Paving Adjacent to Existing Concrete Pavement

Where pavement is placed adjacent to existing concrete pavement:

1. Grinding adjacent pavement must be completed before placing the pavement
2. Use paving equipment with padded crawler tracks or rubber-tired wheels with enough offset to prevent damage
3. Match pavement grade with the elevation of existing concrete pavement after grinding.

40-1.03H(3) Concrete Pavement Transition Panel

For concrete pavement placed in a transition panel, texture the surface with a drag strip of burlap, broom, or spring steel tine device that produces scoring in the finished surface. Scoring must be either parallel or transverse to the centerline. Texture at the time that produces the coarsest texture.

40-1.03H(4) 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 machines 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
6. Uniformly consolidate the concrete across the paving width including adjacent to forms by using high-frequency internal vibrators within 15 minutes of depositing concrete on the subgrade
7. Do not shift the mass of concrete with vibrators.

40-1.03H(5) 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 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.

40-1.03I Edge Treatment

Construct edge treatments as shown. Regrade when required for the preparation of safety edge areas.

Sections 40-1.03J(2) and 40-1.03J(3) do not apply to safety edges.

For safety edges placed after the concrete pavement is complete, concrete may comply with the requirements for minor concrete.

For safety edges placed after the concrete pavement is complete, install connecting bar reinforcement under section 52.

Saw cutting or grinding may be used to construct safety edges.

For safety edges, the angle of the slope must not deviate by more than ± 5 degrees from the angle shown. Measure the angle from the plane of the adjacent finished pavement surface.

40-1.03J Finishing

40-1.03J(1) General

Reserved

40-1.03J(2) Preliminary Finishing

40-1.03J(2)(a) General

Preliminary finishing must produce a smooth and true-to-grade finish. After preliminary finishing, mark each day's paving with a stamp. The stamp must be authorized before paving starts. The stamp must be approximately 1 by 2 feet in size. The stamp must form a uniform mark from 1/8 to 1/4 inch deep. Locate the mark 20 ± 5 feet from the transverse construction joint formed at each day's start of paving and 1 ± 0.25 foot from the 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 pavement's outside edge.

Do not apply water to the pavement surface before float finishing.

40-1.03J(2)(b) Stationary Side Form Finishing

If stationary side form construction is used, give the pavement 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 pavement delivery rate. If the time from paving to machine float finishing exceeds 30 minutes, stop pavement delivery. When machine floats are in proper position, you may resume pavement delivery and paving.
3. Run machine floats on side forms or adjacent pavement lanes. If running on adjacent pavement, protect the adjacent pavement surface under section 40-1.03L. Floats must be hardwood, steel, or steel-shod wood. Floats must be equipped with devices that adjust the underside to a true flat surface.

If using the hand method, finish pavement smooth and true to grade with manually operated floats or powered finishing machines.

40-1.03J(2)(c) Slip-Form Finishing

If slip-form construction is used, the slip-form paver must give the pavement a preliminary finish. You may supplement the slip-form paver with machine floats.

Before the pavement hardens, correct pavement edge slump in excess of 0.02 foot exclusive of edge rounding.

40-1.03J(3) 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 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 deep. 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 raveling.

Construct grooves over the entire pavement width in a single pass except do not construct grooves 3 inches from the 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 the pavement has hardened.

For irregular areas and areas inaccessible to the grooving machine, you may hand-construct grooves using the hand method. Hand-constructed grooves must comply with the specifications for machine-constructed grooves.

For ramp termini, use heavy brooming normal to the ramp centerline to produce a coefficient of friction of at least 0.35 determined on the hardened surface under California Test 342.

40-1.03K Curing

Cure the concrete pavement's exposed area under section 90-1.03B using the waterproof membrane method or curing compound method. If using the curing compound method use curing compound no. 1 or 2. When side forms are removed within 72 hours of the start of curing, also cure the concrete pavement edges.

Apply curing compound with mechanical sprayers. Reapply curing compound to saw cuts and disturbed areas.

40-1.03L Protecting Concrete Pavement

Protect concrete pavement under section 90-1.03C.

Maintain the concrete pavement surface temperature at not less than 40 degrees 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 authorized, you may use RSC for crossings. Do not open crossings until the Department determines that the pavement's modulus of rupture is at least 550 psi under California Test 523 or California Test 524.

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 based on Department's testing except:

1. If the equipment is for sawing contraction joints
2. If authorized, 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.

40-1.03M 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

If you request early use, concrete pavement must have a modulus of rupture of at least 350 psi. Protect concrete pavement under section 40-1.03L.

40-1.03N Reserved

40-1.03O Shoulder Rumble Strip

40-1.03O(1) General

Construct shoulder rumble strips by rolling or grinding indentations in new concrete pavement.

Do not construct shoulder rumble strips on structures or approach slabs.

Construct rumble strips within 2 inches of the specified alignment. Rumble strip 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 nor more than 10 percent in length and width.

Grind or remove and replace noncompliant rumble strip indentations at locations determined by the Engineer. Ground surface areas must be neat and uniform in appearance.

Remove grinding residue under section 42-1.03B.

40-1.03O(2) Rolled-In Indentations

Construct rolled-in indentations before final concrete set. Indentation construction must not displace adjacent concrete.

40-1.03O(3) Ground-In Indentations

Concrete pavement must be hardened before grinding rumble strips indentations. Do not construct indentations until the following occurs:

1. 10 days elapse after concrete placement
2. Concrete has developed a modulus of rupture of 550 psi determined under California Test 523,

40-1.03P Drilling Cores

Drill concrete pavement cores under ASTM C 42/C 42M. Use diamond impregnated drill bits.

Clean, dry, and fill core holes with hydraulic cement grout (nonshrink) or pavement concrete. Coat the core hole walls with epoxy adhesive for bonding new concrete to old concrete under section 95. Finish the backfill to match the adjacent surface elevation and texture.

40-1.03Q Pavement Repair and Replacement

40-1.03Q(1) General

If surface raveling or full-depth cracks occur within one year of Contract acceptance, repair or replace the pavement under section 6-3.06.

Repair and replace pavement in the following sequence:

1. Replace pavement
2. Repair spall, ravel, and working cracks
3. Correct smoothness and coefficient of friction
4. Treat partial depth cracks
5. Replace damaged joint seals under section 41-5

In addition to removing pavement for other noncompliance, remove and replace JPCP slabs that:

1. Have one or more full depth crack
2. Have raveled surfaces such that either:
 - 2.1. Combined raveled areas are more than 5 percent of the total slab area
 - 2.2. Single area is more than 4 sq ft

Remove and replace JPCP 3 feet on both sides of a joint with a rejected dowel bar.

40-1.03Q(2) Spall and Ravel Repair

Repair spalled or raveled areas that are:

1. Deeper than 0.05 foot
2. Wider than 0.10 foot
3. Longer than 0.3 foot

Repairs must comply with section 41-4 and be completed before opening pavement to traffic.

40-1.03Q(3) Crack Repair

Treat partial depth cracks for JPCP under section 41-3.

If the joints are sealed, repair working cracks by routing and sealing. Use a powered rotary router mounted on wheels, with a vertical shaft and a routing spindle that casters as it moves along the crack. Form a reservoir 3/4 inch deep by 3/8 inch wide in the crack. Equipment must not cause raveling nor spalling

Treat the contraction joint adjacent to the working crack by either:

1. Epoxy resin under ASTM C 881/C 881M, Type IV, Grade 2
2. Pressure injecting epoxy resin under ASTM C 881/C881M, Type IV, Grade 1

40-1.03Q(4) Smoothness and Friction Correction

Correct pavement that is noncompliant for:

1. Smoothness by grinding under section 42-3
2. Coefficient of friction by grooving or grinding under section 42

Do not start corrective work until:

1. Pavement has cured 10 days
2. Pavement has at least a 550 psi modulus of rupture
3. Your corrective method is authorized

Correct the entire lane width. Begin and end grinding at lines perpendicular to the roadway centerline. The corrected area must have a uniform texture and appearance.

If corrections are made within areas where testing with an IP is required, retest the entire lane length with an IP under sections 40-1.01D(6)(c) and 40-1.01D(7)(b)(vii).

If corrections are made within areas where testing with a 12-foot straightedge is required, retest the corrected area with a straightedge under sections 40-1.01D(6)(c) and 40-1.01D(7)(b)(vii).

Allow 25 days for the Department's coefficient of friction retesting.

40-1.03R–40-1.03U Reserved

40-1.04 PAYMENT

The payment quantity for pavement is based on the dimensions shown.

The deduction for pavement thickness deficiency in each primary area is shown in the following table:

Deduction for Thickness Deficiency	
Average thickness deficiency (foot) ^a	Deduction(\$/sq yd)
0.01	0.90
0.02	2.30
0.03	4.10
0.04	6.40
0.05	9.11

^aValues greater than 0.01 are rounded to the nearest 0.01 foot.

Shoulder rumble strips are measured by the station along each shoulder on which the rumble strips are constructed without deductions for gaps between indentations.

If the initial cores show that dowel bars or tie bars are within alignment tolerances and the Engineer orders more dowel or tie bar coring, the additional cores are paid for as change order work.

The Department does not pay for additional coring to check dowel or tie bar alignment which you request.

If the Engineer accepts a test strip and it remains as part of the paving surface, the test strip is paid for as the type of pavement involved.

If the curvature of a slab affects tie bar spacing and additional tie bars are required, no additional payment is made for the additional tie bars.

Payment for grinding existing pavement is not included in the payment for the type of pavement involved.

40-2 CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

40-2.01 GENERAL

40-2.01A Summary

Section 40-2 includes specifications for constructing CRCP.

Terminal joints include saw cutting, dowel bars, drill and bond dowel bars, support slab, support slab reinforcement, tack coat, and temporary hot mix asphalt.

Expansion joints include polystyrene, support slab, support slab reinforcement, dowel bars, drill and bond dowel bars, and bond breaker.

Wide flange beam terminals include polyethylene foam, support slab, and support slab reinforcement.

Pavement anchors include cross drains, anchor reinforcement, filter fabric, and permeable material.

40-2.01B Definitions

Reserved

40-2.01C Submittals

Reserved

40-2.01D Quality Control and Assurance

40-2.01D(1) General

Reserved

40-2.01D(2) Testing for Coefficient of Thermal Expansion

For field qualification, test coefficient of thermal expansion under AASHTO T 336. The coefficient of thermal expansion must not exceed 6.0 microstrain/degree Fahrenheit.

40-2.02 MATERIALS

40-2.02A General

Class 1 permeable material, filter fabric, and slotted plastic pipe cross drain as shown for pavement anchors must comply with section 68-3.

40-2.02B Concrete

Concrete for terminal joints, support slabs, and pavement anchors must comply with section 40-1.02.

40-2.02C Transverse Bar Assembly

Instead of transverse bar and other support devices, you may use transverse bar assemblies to support longitudinal bar. Bar reinforcement and wire must comply with section 40-1.02C.

40-2.02D Wide Flange Beam

Wide flange beams and studs must be either rolled structural steel shapes under ASTM A 36/A 36M or structural steel under ASTM A 572/A 572M.

40-2.02E Joints

Joint seals for wide flange beam terminals must comply with section 51-2.02.

Joint seals for transverse expansion joints must comply with section 51-2.02.

Expanded polystyrene for transverse expansion joints must comply with section 51-2.01B(1).

40-2.03 CONSTRUCTION

40-2.03A General

Reserved

40-2.03B Test Strips

Comply with section 40-1.03C except during the evaluation, the Engineer visually checks reinforcement, dowel and tie bar placement.

40-2.03C Construction Joints

Transverse construction joints must be perpendicular to the lane line. Construct joints to allow for lap splices of the longitudinal bar. Comply with the lap splice lengths shown for CRCP.

Clean construction joint surfaces before placing fresh concrete against the joint surfaces. Remove surface laitance, curing compound, and other foreign materials.

40-2.03D Bar Reinforcement

Place bar reinforcement under section 52-1.03D, except you may request to use plastic chairs. Plastic chairs will only be considered for support directly under the transverse bars. Your request to use plastic chairs must include a sample of the plastic chair, the manufacturer's written recommendations for the applicable use and load capacity, chair spacing, and your calculation for the load on a chair for the area of bar reinforcement sitting on it. Vertical and lateral stability of the bar reinforcement and plastic chairs must be demonstrated during construction of the test strip. Obtain authorization before using the proposed plastic chairs for work after the test strip is accepted.

For transverse bar 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 as shown.

40-2.03E Wide Flange Beams

Weld stud ends with an electric arc welder completely fusing the studs to the wide flange beam. Replace studs dislodged in shipping or that can be dislodged with a hammer.

40-2.03F Repair and Replacement

40-2.03F(1) General

Requirements for repair of cracks under section 40-1.03Q do not apply to CRCP. High molecular weight methacrylate is not to be applied to cracks in CRCP.

New CRCP will be monitored for 1 year from contract acceptance or relief from maintenance, whichever is less. CRCP that develops raveling areas of 6 inches by 6 inches or greater will require partial depth repair under section 6-3.06. CRCP that develops one or more full-depth transverse cracks with faulting greater than 0.25 inch or one or more full-depth longitudinal cracks with faulting greater 0.50 inch will require full depth repair.

40-2.03F(2) Partial Depth Repair

Partial depth repair must comply with section 41-4 except:

1. Determine a rectangular boundary which extends 6 inches beyond the damaged area. The limits of saw depth must be between 2 inches from the surface to 1/2 inch above the longitudinal bars.
2. If each length of the repair boundaries is equal to or greater than 3 ft, additional reinforcement is needed for the repair area. Submit a plan for authorization before starting the repair.

40-2.03F(3) Full Depth Repair

40-2.03F(3)(a) General

Removal of CRCP must be full depth except for portion of reinforcement to remain. Provide continuity of reinforcement. Comply with section 52-6. Submit a plan for authorization, before starting the repair. Do not damage the base, concrete and reinforcement to remain. Place concrete in the removal area.

40-2.03F(3)(b) Transverse Cracks

Make initial full-depth transverse saw cuts normal to the lane line a distance of 3 feet on each side of the transverse crack.

40-2.03F(3)(c) Longitudinal Cracks

Remove the cracked area normal to the lane line for the full width of the lane a distance of 1 foot beyond the ends of the crack. You may propose alternate limits with your repair plan for authorization.

40-2.03G Reserved

40-2.04 PAYMENT

Not Used

40-3 RESERVED

40-4 JOINTED PLAIN CONCRETE PAVEMENT

40-4.01 GENERAL

40-4.01A Summary

Section 40-4 includes specifications for constructing JPCP.

40-4.01B Definitions

Reserved

40-4.01C Submittals

40-4.01C(1) General

Reserved

40-4.01C(2) Early Age Crack Mitigation System

At least 24 hours before each paving shift, submit the following information as an informational submittal:

1. Early age stress and strength predictions
2. Scheduled sawing and curing activities
3. Contingency plan if cracking occurs

40-4.01C(3)–40-4.01C(8) Reserved

40-4.01D Quality Control and Assurance

40-4.01D(1) General

Reserved

40-4.01D(2) Quality Control Plan

The QC plan must include 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.

40-4.01D(3) Early Age Crack Mitigation System

For JPCP, develop and implement a system for predicting stresses and strength during the initial 72 hours after paving. The system must include:

1. Subscription to a weather service to obtain forecasts for wind speed, ambient temperatures, humidity, and cloud cover
2. Portable weather station with an anemometer, temperature and humidity sensors, located at the paving site
3. Early age concrete pavement stress and strength prediction plan
4. Analyzing, monitoring, updating, and reporting the system's predictions

40-4.01D(4)–40-4.01D(9) Reserved

40-4.02 MATERIALS

Not Used

40-4.03 CONSTRUCTION

40-4.03A General

Transverse contraction joints on a curve must be on a single straight line through the curve's radius point. If transverse joints do not align in a curve, drill a full depth 2" diameter hole under ASTM C 42/C 42M where the joint meets the adjacent slab. Fill the hole with joint filler. If joints are not sealed, avoid joint filler material penetration into the joint.

40-4.03B Repair and Replacement

If replacing concrete, saw cut and remove to full depth.

41-1.02B Fast-Setting Concrete

Fast-setting concrete must be one of the following:

1. Magnesium phosphate concrete that is either:
 - 1.1. Single component water activated
 - 1.2. Dual component with a prepackaged liquid activator
2. Modified high-alumina based concrete
3. Portland cement based concrete

Fast-setting concrete must be stored in a cool and dry environment.

If used, the addition of retarders must comply with the manufacturer's instructions.

You may use any accelerating chemical admixtures complying with ASTM C494/C494M, Type C and section 90-1.02E.

Fast-setting concrete properties must have the values shown in the following table:

Fast-Setting Concrete		
Property	Test method	Value
Compressive strength ^a (psi, min)		
at 3 hours	California Test 551	3,000
at 24 hours	California Test 551	5,000
Flexural strength ^a (psi, min, at 24 hours)	California Test 551	500
Bond strength ^a (psi, min, at 24 hours)		
Saturated surface dry concrete	California Test 551	300
Dry concrete	California Test 551	400
Water absorption (% max)	California Test 551	10
Abrasion resistance ^a (g, max, at 24 hours)	California Test 550	25
Drying shrinkage (% max, at 4 days)	ASTM C596	0.13
Water soluble chlorides ^b (% max, by weight)	California Test 422	0.05
Water soluble sulfates ^b (% max, by weight)	California Test 417	0.25
Thermal stability (% min)	California Test 553	90

^aPerform test with aggregate filler if used.

^bTest must be performed on a cube specimen, fabricated under California Test 551, cured at least 14 days, and then pulverized to 100% passing the no. 50 sieve.

Aggregate filler may be used to extend prepackaged concrete. Aggregate filler must:

1. Be clean and uniformly rounded.
2. Have a moisture content of 0.5-percent by weight or less when tested under California Test 226.
3. Comply with sections 90-1.02C(2) and 90-1.02C(3).
4. Not exceed 50 percent of the concrete volume or the maximum recommended by the fast-setting concrete manufacturer, whichever is less.

When tested under California Test 202, aggregate filler must comply with the grading in the following table:

Aggregate Filler Grading	
Sieve size	Percentage passing
3/8 inch	100
No. 4	50–100
No. 16	0–5

41-1.02C Polyester Concrete

Polyester concrete consists of polyester resin binder and dry aggregate. The polyester resin binder must be an unsaturated isophthalic polyester-styrene copolymer.

Polyester resin binder properties must have the values shown in the following table:

Polyester Resin Binder

Property	Test method	Value
Viscosity ^a (Pa·s) RVT, No. 1 spindle, 20 RPM at 77 °F	ASTM D2196	0.075– 0.200
Specific gravity ^a (77 °F)	ASTM D1475	1.05–1.10
Elongation (%), min Type I specimen, 0.25 ± 0.03 inch thick Speed of testing = 0.45 inch/minute Condition 18/25/50+5/70: T—23/50	ASTM D638 ASTM D618	35
Tensile strength (psi), min Type I specimen, 0.25 ± 0.03 inch thick Speed of testing = 0.45 inch/minute Condition 18/25/50+5/70: T—23/50	ASTM D638 ASTM D618	2,500
Styrene content ^a (%), by weight)	ASTM D2369	40–50
Silane coupler (%), min, by weight of polyester resin binder)	--	1.0
PCC saturated surface-dry bond strength at 24 hours and 70 ± 2 °F (psi, min)	California Test 551	500
Static volatile emissions ^a (g/sq m, max)	South Coast Air Quality Management District, Method 309-91 ^b	60

^aPerform the test before adding initiator.

^bFor the test method, go to:

<http://www.aqmd.gov/tao/methods/lab/309-91.pdf>

Silane coupler must be an organosilane ester, gamma-methacryloxypropyltrimethoxysilane. Promoter must be compatible with suitable methyl ethyl ketone peroxide (MEKP) and cumene hydroperoxide (CHP) initiators.

Aggregate for polyester concrete must comply with section 90-1.02C(1), 90-1.02C(2), and 90-1.02C(3).

When tested under California Test 202, the combined aggregate grading must comply with one of the gradations in the following table:

Combined Aggregate Grading

Sieve size	Percentage passing		
	A	B	C
1/2"	100	100	100
3/8"	83–100	100	100
No. 4	65–82	62–85	45–80
No. 8	45–64	45–67	35–67
No. 16	27–48	29–50	25–50
No. 30	12–30	16–36	15–36
No. 50	6–17	5–20	5–20
No. 100	0–7	0–7	0–9
No. 200	0–3	0–3	0–6

Aggregate retained on the no. 8 sieve must have a maximum of 45 percent crushed particles under California Test 205. Fine aggregate must be natural sand.

The weighted average absorption must not exceed 1 percent when tested under California Tests 206 and 207.

You may submit an alternative grading or request to use manufactured sand as fine aggregate but 100 percent of the combined grading must pass the 3/8 inch sieve. Allow 21 days for authorization.

Polyester concrete must have a minimum compressive strength of 1250 psi at 3 hours and 30 minutes under California Test 551 or ASTM C109.

41-1.02D Bonding Agent

Bonding agent must comply with the concrete manufacturer's recommendations.

41-1.02E Temporary Pavement Structure

Temporary pavement structure consists of RSC or aggregate base with HMA. RSC not conforming to the specifications may serve as temporary pavement structure if:

1. The modulus of rupture is at least 200 psi before opening to traffic
2. RSC thickness is greater than or equal to the existing concrete pavement surface layer
3. RSC is replaced during the next paving shift

Aggregate base for temporary pavement structure must comply with the 3/4-inch maximum grading specified in section 26-1.02B.

HMA must comply with section 39-1.15 except do not use HMA Type B.

41-1.02F Reserved

41-1.03 CONSTRUCTION

41-1.03A General

Repair only the portion of pavement where the work will be completed during the same lane closure. If removal is required, remove only the portion of pavement where the repair will be completed during the same traffic closure. Completion of concrete repair includes curing until the concrete attains the specified minimum properties required before opening the repaired pavement to traffic.

If you fail to complete the concrete pavement repair during the same lane closure, construct temporary pavement before opening the lane to traffic.

Before starting repair work, except saw cutting: the equipment, materials, and personnel for constructing temporary pavement structure must be at the job site or an approved location. If HMA can be delivered to the job site within 1 hour, you may request 1-hour delivery as an alternative to having the HMA at the job site.

Maintain the temporary pavement structure and replace it as a first order of work as soon as you resume concrete pavement repair work.

After removing temporary pavement structure, you may stockpile that aggregate base at the job site and reuse it for temporary pavement structure.

41-1.03B Mixing and Applying Bonding Agent

Mix and apply the bonding agent at the job site under the manufacturer's instructions and in small quantities.

Apply bonding agent after cleaning the surface and before placing concrete.

Apply a thin, even coat of bonding agent with a stiff bristle brush until the entire repair surface is scrubbed and coated with bonding agent.

41-1.03C Mixing Concrete

41-1.03C(1) General

Mix concrete in compliance with the manufacturer's instructions. For repairing spalls, mix in a small mobile drum or paddle mixer. Comply with the manufacturer's recommended limits for the quantity of aggregate filler, water, and liquid activator.

Mix the entire contents of prepackaged dual-component magnesium phosphate concrete as supplied by the manufacturer. Use the full amount of each component and do not add water to dual-component magnesium phosphate concrete.

Magnesium phosphate concrete must not be mixed in containers or worked with tools containing zinc, cadmium, aluminum, or copper.

Modified high-alumina based concrete must not be mixed in containers or worked with tools containing aluminum.

41-1.03C(2) Polyester Concrete

When mixing with resin, the moisture content of the combined aggregate must not exceed 1/2 of the average aggregate absorption when tested under California Test 226.

Proportion the polyester resin and aggregate to produce a mixture with suitable workability for the intended work. Only a minimal amount of resin may rise to the surface after finishing.

41-1.03D Placing Concrete

The pavement surface temperature must be at least 40 degrees F before placing concrete. You may propose methods to heat the surfaces.

Place magnesium phosphate concrete on a dry surface.

Place portland cement and modified high-alumina concrete on surfaces treated with a bonding agent recommended by the concrete manufacturer. If no bonding agent is recommended by the manufacturer, place concrete on damp surfaces that are not saturated.

Do not retemper concrete. Use dry finishing tools cleaned with water before working the concrete.

41-1.03E Curing Concrete

Cure concrete under the manufacturer's instructions. When curing compound is used, comply with section 90-1.03B for curing compound no. 1 or 2.

41-1.03F Reserved

41-1.04 PAYMENT

Not Used

41-2 SUBSEALING AND JACKING

41-2.01 GENERAL

41-2.01A Summary

Section 41-2 includes specifications for filling voids under existing concrete pavement.

41-2.01B Definitions

Reserved

41-2.01C Submittals

Submit shipping invoices with packaged or bulk fly ash and cement.

Before grouting activities begin, submit a proposal for the materials to be used. Include authorized laboratory test data for the grout indicating:

1. Time of initial setting under ASTM C266.
2. Compressive strength results at 1, 3, and 7 days for 10, 12, and 14-second grout efflux times.

If requesting a substitution of grout materials, submit a proposal that includes test data.

41-2.01D Quality Control and Assurance

Reserved

41-2.02 MATERIALS

41-2.02A General

Reserved

41-2.02B Grout

Grout must consist of Type II portland cement, fly ash, and water. Use from 2.4 to 2.7 parts fly ash to 1 part portland cement by weight. Use enough water to produce the following grout efflux times determined under California Test 541, Part D:

1. From 10 to 16 seconds for subsealing
2. From 10 to 26 seconds for jacking

Cement for grout must comply with the specifications for Type II portland cement in section 90-1.02B(2).

Fly ash must comply with AASHTO M 295, Class C or Class F. Fly ash sources must be on the Authorized Material List.

You may use chemical admixtures and calcium chloride. Chemical admixtures must comply with section 90-1.02E(2). Calcium chloride must comply with ASTM D98.

Test grout compressive strength under California Test 551, Part 1 at 7-days with 12 seconds efflux time. Follow the procedures for moist cure. The 7-day compressive strength must be at least 750 psi.

41-2.02C Mortar

Mortar must be a prepackaged fast-setting mortar that complies with ASTM C928.

41-2.02D Reserved

41-2.03 CONSTRUCTION

41-2.03A General

Drill holes in the pavement, inject grout, plug the holes, and finish the holes with mortar.

Drill holes through the pavement and underlying base to a depth from 15 to 18 inches below the pavement surface. The hole diameter must match the fitting for the grout injecting equipment.

41-2.03B Injecting Grout

41-2.03B(1) General

Inject grout within 2 days of drilling holes.

Immediately before injecting grout, clean the drilled holes with water at a minimum pressure of 40 psi. The cleaning device must have at least 4 jets that direct water horizontally at the slab-base interface.

Do not inject grout if the atmospheric or subgrade temperature is below 40 degrees F. Do not inject grout in inclement weather. If water is present in the holes, obtain the Engineer's authorization before injecting grout.

Do not inject grout until at least 2 consecutive slabs requiring subsealing are drilled ahead of the grouting activities.

The grout plant must have a positive displacement cement injection pump and a high-speed colloidal mixer capable of operating from 800 to 2,000 rpm. The injection pump must sustain 150 psi if pumping grout with a 12-second efflux time. A pressure gauge must be located immediately adjacent to the supply valve of the grout hose supply valve and positioned for easy monitoring.

Before mixing, weigh dry cement and fly ash if delivered in bulk. If the materials are packaged, each container must weigh the same.

Introduce water to the mixer through a meter or scale.

Inject grout under pressure until the voids under the pavement slab are filled. The injection nozzle must not leak. Do not inject grout if the nozzle is below the bottom of the slab. Inject grout 1 hole at a time.

Stop injecting grout in a hole if either:

1. Grout does not flow under a sustained pump gauge pressure of 150 psi after 7 seconds and there is no indication the slab is moving.
2. Injected grout rises to the surface at any joint or crack, or flows into an adjacent hole.

Dispose of unused grout within 1 hour of mixing.

41-2.03B(2) Subsealing

If a slab raises more than 1/16 inch due to grout injection, stop injecting grout in that hole.

41-2.03B(3) Jacking

The positive displacement pump used for grout injection must be able to provide a sustained gauge pressure of 200 psi. Gauge pressures may be from 200 to 600 psi for brief periods to start slab movement.

You may add additional water to initiate pressure injection of grout. Do not reduce the grout efflux time below 10 seconds.

Raise the slabs uniformly. Use string lines to monitor the pavement movement.

Do not move adjacent slabs not specified for pavement jacking. If you move adjacent slabs, correct the grade within the tolerances for final pavement elevation.

41-2.03B(4) Finishing

Immediately after removing the injection nozzle, plug the hole with a round, tapered wooden plug. Do not remove plugs until adjacent holes are injected with grout and no grout surfaces through previously injected holes.

After grouting, remove grout from drilled holes at least 4 inches below the pavement surface. Clean holes and fill with mortar. Finish filled holes flush with the pavement surface.

41-2.03B(5) Tolerances

The final pavement elevation must be within 0.01 foot of the required grade. If the final pavement elevation is between 0.01 and 0.10 foot higher than the required grade, grind the noncompliant pavement surface under section 42 to within 0.01 foot of the required grade.

If the final pavement elevation is higher than 0.10 foot from the required grade, remove and replace the noncompliant pavement under section 41-9.

41-2.04 PAYMENT

The payment quantity for subsealing is calculated by adding the dry weight of cement and fly ash used for the placed grout. The payment quantity for jacking is calculated by adding the dry weight of cement and fly ash used for the placed grout.

The Department does not pay for wasted grout.

The Department does not adjust the unit price for an increase or decrease in the subsealing quantity.

The Department does not adjust the unit price for an increase or decrease in the jacking quantity.

41-3 CRACK TREATMENT

41-3.01 GENERAL

41-3.01A Summary

Section 41-3 includes specifications for applying high-molecular-weight methacrylate (HMWM) to concrete pavement surface cracks that do not extend the full slab depth.

41-3.01B Definitions

Reserved

41-3.01C Submittals

41-3.01C(1) General

Submit HMWM samples 20 days before use.

If sealant is to be removed, submit the proposed removal method at least 7 days before sealant removal. Do not remove sealant until the proposed sealant removal method is authorized.

41-3.01C(2) Public Safety and Placement Plans

Before starting crack treatment, submit a public safety plan for HMWM and a placement plan for construction activity as shop drawings.

The public safety and placement plans must identify the materials, equipment, and methods to be used.

In the public safety plan, include the MSDS for each component of HMWM and details for:

1. Shipping
2. Storage
3. Handling
4. Disposal of residual HMWM and containers

If the project is in an urban area adjacent to a school or residence, the public safety plan must also include an airborne emissions monitoring plan prepared by a CIH certified in comprehensive practice by the American Board of Industrial Hygiene. Submit a copy of the CIH's certification. The CIH must monitor the emissions at a minimum of 4 points including the mixing point, the application point, and the point of nearest public contact. At work completion, submit a report by the industrial hygienist with results of the airborne emissions monitoring plan.

The placement plan must include:

1. Crack treatment schedule including coefficient of friction testing
2. Methods and materials including:
 - 2.1. Description of equipment for applying HMWM
 - 2.2. Description of equipment for applying sand
 - 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.

41-3.01C(3) Reserved

41-3.01D Quality Control and Assurance

41-3.01D(1) General

Use test tiles to evaluate the HMWM cure time. Coat at least one 4 by 4 inch smooth glazed tile for each batch of HMWM. Place the coated tile adjacent to the area being treated. Do not apply sand to the test tiles.

Use the same type of crack treatment equipment for testing and production.

41-3.01D(2) Test Area

Before starting crack treatment, treat a test area of at least 500 square feet within the project limits at a location accepted by the Engineer. Use test areas outside the traveled way if available.

Treat the test area under weather and pavement conditions similar to those expected during crack treatment production.

The Engineer evaluates the test area based on the acceptance criteria. Do not begin crack treatment until the Engineer accepts the test area.

41-3.01D(3) Reserved

41-3.01D(4) Acceptance Criteria

The Engineer accepts a treated area if:

1. Corresponding test tiles are dry to the touch
2. Treated surface is tack-free and not oily
3. Sand cover adheres enough to resist hand brushing
4. Excess sand is removed
5. Coefficient of friction is at least 0.30 when tested under California Test 342

41-3.02 MATERIALS

HMWM consists of compatible resin, promoter, and initiator. HMWM resin may be prepromoted by mixing promoter and resin together before filling containers. Identify prepromoted resin on the container label.

Adjust the gel time to compensate for temperature changes throughout the application.

HMWM resin properties must have the following values:

Property	Test method	Value
Viscosity ^a (cP, max, Brookfield RVT with UL adapter, 50 RPM at 77 °F)	ASTM D2196	25
Specific gravity ^a (min, at 77 °F)	ASTM D1475	0.90
Flash point ^a (°F, min)	ASTM D3278	180
Vapor pressure ^a (mm Hg, max, at 77 °F)	ASTM D323	1.0
Tack-free time (minutes, max, at 77 °F)	Specimen prepared under California Test 551	400
Volatile content ^a (% , max)	ASTM D2369	30
PCC saturated surface-dry bond strength (psi, min, at 24 hours and 77 ± 2 °F)	California Test 551	500

^aPerform the test 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 when tested under California Test 202.

41-3.02D Reserved

41-3.03 CONSTRUCTION

41-3.03A General

Before applying HMWM, 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, 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 being treated.

The equipment applying HMWM 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 manually to prevent overspray onto adjacent traffic. If applying resin manually, limit the batch quantity of HMWM to 5 gallons.

Apply HMWM at a rate of 90 square feet per gallon. The prepared area must be dry and the surface temperature must be from 50 to 100 degrees F while applying HMWM. Do not apply HMWM if the ambient relative humidity is more than 90 percent.

Protect existing facilities from HMWM. Repair or replace existing facilities contaminated with HMWM at your expense.

Flood the treatment area with HMWM to penetrate the pavement and cracks. Apply HMWM within 5 minutes after complete mixing. Mixed HMWM 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 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 0.30 determined under California Test 342

41-3.04 PAYMENT

Not Used

41-4 SPALL REPAIR

41-4.01 GENERAL

Section 41-4 includes specifications for repairing spalls in concrete pavement.

41-4.02 MATERIALS

Repair spalls using polyester concrete with a bonding agent. The bonding agent must comply with the requirements for HMWM in section 41-3.02 except tack-free time requirements do not apply and the HMWM must not contain wax.

Form board must be corrugated cardboard with a 6-mil polyethylene covering.

41-4.03 CONSTRUCTION

41-4.03A General

Prepare spall areas by removing concrete and cleaning. Use a form board to provide compression relief at joints and cracks.

After completing spall repairs do not allow traffic on the repairs for at least 2 hours after the time of final setting under ASTM C403/403M.

41-4.03B Remove Pavement

The Engineer determines the rectangular limits of unsound concrete pavement. Before removing pavement, mark the saw cut lines and spall repair area on the pavement surface.

Do not remove pavement until the Engineer verbally authorizes the saw cut area.

Use a power-driven saw with a diamond blade.

Remove pavement as shown and:

1. From the center of the repair area towards the saw cut
2. To the full saw cut depth
3. At least 2 inches beyond the saw cut edge to produce a rough angled surface

Produce a rough surface by chipping or other removal methods that do not damage the pavement remaining in-place. Completely remove any saw overcuts. Pneumatic hammers used for concrete removal must weigh 15 lbs or less.

If you damage concrete pavement outside the removal area, enlarge the area to remove the damaged pavement.

If dowel bars are exposed during removal, remove concrete from the exposed surface and cover with duct tape.

41-4.03C Cleaning

After pavement has been removed, clean the exposed faces of the concrete by:

1. Sand or water blasting. Water blasting equipment must be capable of producing a blast pressure of 3,000 to 6,000 psi.

2. Blowing the exposed concrete area with compressed air free of moisture and oil to remove debris after blasting. Air compressors must deliver air at a minimum of 120 cfm and develop 90 psi of nozzle pressure.

41-4.03D Form Board Installation

After cleaning, place the form board to match the existing joint or crack alignment. Extend the form board at least 3 inches beyond each end of the repair and at least 1 inch deeper than the repair. Remove the form board before sealing joints or cracks.

41-4.03E–41-4.03I Reserved

41-4.04 PAYMENT

Payment is calculated based on the authorized saw cut area.

The Department does not adjust the unit price for an increase or decrease in the spall repair quantity.

41-5 JOINT SEALS

41-5.01 GENERAL

41-5.01A Summary

Section 41-5 includes specifications for sealing concrete pavement joints or replacing existing concrete pavement joint seals. Pavement joints include isolation joints.

41-5.01B Definitions

Reserved

41-5.01C Submittals

At least 15 days before delivery to the job site, submit a certificate of compliance, MSDS, manufacturer's recommendations, and instructions for storage and installation of:

1. Liquid joint sealant.
2. Backer rods. Include the manufacturer data sheet verifying compatibility with the liquid joint sealant.
3. Preformed compression joint seal. Include the manufacturer data sheet used to verify the seal for the joint dimensions shown.
4. Lubricant adhesive.

Asphalt rubber joint sealant containers must comply with ASTM D6690. Upon delivery of asphalt rubber joint sealant to the job site, submit a certified test report for each lot based on testing performed within 12 months.

Submit a work plan for removing pavement and joint materials. Allow 10 days for authorization. Include descriptions of the equipment and methods for removal of existing pavement and joint material.

41-5.01D Quality Control and Assurance

41-5.01D(1) General

Before sealing joints, arrange for a representative from the manufacturer to provide training on cleaning and preparing the joint and installing the liquid joint sealant or preformed compression joint seal. Do not seal joints until your personnel and the Department's personnel have been trained.

The Engineer accepts joint seals based on constructed dimensions and visual inspection of completed seals for voids.

41-5.01D(2) Reserved

41-5.02 MATERIALS

41-5.02A General

Use the type of seal material described.

Silicone or asphalt rubber joint sealant must not bond or react with the backer rod.

41-5.02B Silicone Joint Sealant

Silicone joint sealant must be on the Authorized Material List.

41-5.02C Asphalt Rubber Joint Sealant

Asphalt rubber joint sealant must:

1. Be paving asphalt mixed with not less than 10 percent ground rubber by weight. Ground rubber must be vulcanized or a combination of vulcanized and devulcanized materials that pass a no. 8 sieve.
2. Comply with ASTM D6690 for Type II.
3. Be capable of melting at a temperature below 400 degrees F and applied to cracks and joints.

41-5.02D Backer Rods

Backer rods must:

1. Comply with ASTM D5249:
 - 1.1. Type 1 for asphalt rubber joint sealant
 - 1.2. Type 1 or Type 3 for silicone joint sealant
2. Be expanded, closed-cell polyethylene foam
3. Have a diameter at least 25 percent greater than the saw cut joint width

41-5.02E Preformed Compression Joint Seals

Preformed compression joint seals must:

1. Comply with ASTM D2628
2. Have 5 or 6 cells, except seals 1/2 inch wide or less may have 4 cells

Lubricant adhesive used to install seals must comply with ASTM D2835.

41-5.02F–41-5.02K Reserved

41-5.03 CONSTRUCTION

41-5.03A General

If joint sealing is described for new concrete pavement, do not start joint sealing activities until the pavement has been in place for at least 7 days. Seal new concrete pavement joints at least 7 days after concrete pavement placement if shown.

Remove existing pavement and joint material by sawing, rectangular plowing, cutting, or manual labor. Saw cut the reservoir before cleaning the joint. Use a power-driven saw with a diamond blade.

If you damage a portion of the pavement to remain in place, repair the pavement under section 41-4.

41-5.03B Joint Cleaning

41-5.03B(1) General

Clean the joint after removal and any repair is complete before installing joint seal material. Cleaning must be completed no more than 4 hours before installing backer rods, liquid joint seal, or preformed compression seals using the following sequence:

1. Removing debris
2. Drying
3. Sandblasting
4. Air blasting
5. Vacuuming

Clean in 1 direction to minimize contamination of surrounding areas.

41-5.03B(2) Removing Debris

Remove debris including dust, dirt, and visible traces of old sealant from the joint after sawing, plowing, cutting, or manual removal. Do not use chemical solvents to wash the joint.

41-5.03B(3) Drying

After removing debris, allow the reservoir surfaces to dry or remove moisture and dampness at the joint with compressed air that may be moderately hot.

41-5.03B(4) Sandblasting

After the joint is dry, sandblast the reservoir to remove remaining residue using a 1/4-inch diameter nozzle and 90 psi minimum pressure. Do not sandblast straight into the reservoir. Angle the sandblasting nozzle within 1 to 2 inches from the concrete and make at least 1 pass to clean each reservoir face.

41-5.03B(5) Air Blasting

After sandblasting, air blast the reservoir to remove sand, dirt, and dust 1 hour before sealing the joint. Use compressed air free of oil and moisture delivered at a minimum rate of 120 cfm and 90 psi nozzle pressure.

41-5.03B(6) Vacuuming

After air blasting, use a vacuum sweeper to remove debris and contaminants from the pavement surfaces surrounding the joint.

41-5.03B(7) Reserved

41-5.03C Installing Liquid Joint Sealant

Where backer rods are shown, place the rods before installing liquid joint sealant. Place backer rods under the manufacturer's instructions unless otherwise specified. The pavement and reservoir surfaces must be dry and the ambient air temperature must be at least 40 degrees F and above the dew point. The reservoir surface must be free of residue or film. Do not puncture the backer rod.

Immediately after placing the backer rod, install liquid joint sealant under the manufacturer's instructions unless otherwise specified. Before installing, demonstrate that fresh liquid sealant is ejected from the nozzle free of cooled or cured material. For asphalt rubber joint sealant, the pavement surface temperature must be at least 50 degrees F before installing.

Pump liquid joint sealant through a nozzle sized for the width of the reservoir so that liquid joint sealant is placed directly onto the backer rod. The installer must draw the nozzle toward his body and extrude liquid joint sealant evenly. Liquid joint sealant must maintain continuous contact with the reservoir walls during extrusion.

After placing liquid joint sealant, recess it to the depth shown within 10 minutes of installation and before a skin begins to form.

After each joint is sealed, remove excess liquid joint sealant on the pavement surface. Do not allow traffic over the sealed joints until the liquid joint sealant is set, tack free, and firm enough to prevent embedment of roadway debris.

41-5.03D Installing Preformed Compression Joint Seals

Install preformed compression joint seals using lubricant adhesive as shown and under the manufacturer's instructions.

Install longitudinal seals before transverse seals. Longitudinal seals must be continuous except splicing is allowed at intersections with transverse seals. Transverse seals must be continuous for the entire transverse length of concrete pavement except splices are allowed for widening and staged construction. 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.

If splicing is authorized, comply with the manufacturer's instructions.

Use a machine specifically designed for preformed compression joint 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. Without stretching the seal more than 4 percent

Cut preformed compression joint seal material to the exact length of the pavement joint to be sealed. The Engineer measures this length. After you install the preformed compression joint seal, the Engineer

measures the excess length of material at the joint end. The Engineer divides the excess length by the measured cut length to determine the stretch percentage.

Seals must be compressed from 30 to 50 percent of the joint width when complete in place.

41-5.03E Reserved

41-5.04 PAYMENT

Not Used

41-6 CRACK AND SEAT

41-6.01 GENERAL

41-6.01A Summary

Section 41-6 includes specifications for cracking, seating, and preparing the surface of existing concrete pavement.

41-6.01B Definitions

Reserved

41-6.01C Submittals

Submit each core in a plastic bag or tube for acceptance at the time of sampling. Mark each core with a location description.

41-6.01D Quality Control and Assurance

41-6.01D(1) General

If cracking is noncompliant:

1. Stop crack and seat work
2. Modify your equipment and procedures and crack the noncompliant pavement again
3. Construct another test section
4. Take additional core samples to verify compliance
5. Construct an inspection strip if the concrete pavement has HMA on the surface

41-6.01D(2) Test Section

The Engineer determines and marks a test section up to 1000 square feet within the crack and seat area shown. Construct the test section and obtain the Engineer's verbal authorization before starting crack and seat work.

Immediately before cracking the test section, apply water to the pavement surface so that cracking can be readily evaluated. Crack the test section and vary impact energy and striking patterns to verify your procedure.

41-6.01D(3) Coring

Drill cores at least 6 inches in diameter under ASTM C42 to verify cracking in the Engineer's presence. Take at least 2 cores per test section and 1 core per lane mile for each pavement cracking machine used. The Engineer determines the core locations.

41-6.01D(4) Reserved

41-6.02 MATERIALS

41-6.02A General

Use fast-setting or polyester concrete to fill core holes.

41-6.03 CONSTRUCTION

41-6.03A Cracking

Crack existing concrete pavement using the procedures and equipment from the authorized test section.

Do not allow flying debris during cracking operations.

Crack existing concrete pavement into segments that nominally measure 6 feet transversely by 4 feet longitudinally. If the existing pavement is already cracked into segments, crack it into equal-sized square

or rectangular pieces that nominally measure not more than 6 feet transversely and from 3 to 5 feet longitudinally. Do not impact the pavement within 1 foot of another break line, pavement joint, or edge of pavement.

Cracks must be vertical, continuous, and penetrate the full depth of pavement. Cracks must be within 6 inches of vertical along the full depth of pavement. Do not cause surface spalling over 0.10-foot deep or excessive shattering of the pavement or base.

Cracking equipment must impact the pavement with a variable force in a controlled location. Do not use unguided free-falling weights such as "headache balls."

If the concrete pavement has no more than 0.10 foot of asphalt concrete on the surface, you may crack the pavement without removing the asphalt concrete. After cracking, construct an inspection strip by removing at least 500 square feet of asphalt concrete at a location determined by the Engineer. Construct additional inspection strips to demonstrate compliance where ordered by the Engineer.

After cracking, allow public traffic on the cracked or initial pavement layer for no more than 15 days.

41-6.03B Seating

Seat cracked concrete by making at least 5 passes over the cracked concrete with either:

1. Oscillating pneumatic-tired roller under section 39-3.03 and at least 15 tons
2. Vibratory pad-foot roller exerting a dynamic centrifugal force of at least 10 tons

A pass is 1 movement of a roller in either direction at 5 mph or less.

After all segments have been seated, clean loose debris from joints and cracks using compressed air free of moisture and oil.

Reseat any segment of cracked pavement that has not been overlaid within 24 hours of seating.

41-6.03C Surface Preparation

Before opening cracked and seated pavement to traffic or overlaying:

1. Fill joints, cracks, and spalls wider than 3/4 inch and deeper than 1 inch by applying tack coat and placing HMA under section 39-1.15, except use the no. 4 gradation instead of 3/8-inch.
2. Remove all loose debris and sweep the pavement.

41-6.03D Reserved

41-6.04 PAYMENT

Crack and seat existing concrete pavement is measured from the area of pavement cracked and seated. No deduction is made for existing cracked segments. The Department does not pay for HMA used to fill joints, cracks, and spalls.

41-7 TRANSITION TAPER

41-7.01 GENERAL

Section 41-7 includes specifications for constructing transition tapers in existing pavement.

41-7.02 MATERIALS

Not Used

41-7.03 CONSTRUCTION

Construct transition tapers by either grinding or removing and replacing the existing concrete. Do not allow flying debris during the construction of tapers.

Grinding must comply with section 42.

Replacement concrete must comply with section 41-9 except place concrete to the taper level shown and finish the surface with a coarse broom.

If the transition taper will be overlaid with HMA that is not placed before opening to traffic and there is a grade difference of more than 0.04 foot, construct a temporary taper by placing HMA that complies with section 39-1.15. Remove the temporary HMA taper before constructing the transition taper.

41-7.04 PAYMENT

Pavement transition tapers are measured using the dimensions shown. The Department does not pay for temporary HMA tapers.

41-8 DOWEL BAR RETROFIT

Reserved

41-9 INDIVIDUAL SLAB REPLACEMENT WITH RAPID STRENGTH CONCRETE

41-9.01 GENERAL

41-9.01A Summary

Section 41-9 includes specifications for removing existing concrete pavement and constructing individual slab replacement with rapid strength concrete (ISR—RSC).

41-9.01B Definitions

concrete raveling: Disintegration of the concrete surface layer from aggregate loss.

early age: Any age less than 10 times the time of final setting for concrete determined under ASTM C403/C403M.

full-depth crack: Crack that runs from one edge of the concrete slab to the opposite or adjacent side of the slab.

opening age: Age when the minimum modulus of rupture specified for opening to traffic and equipment is attained.

time of final setting: Elapsed time required to develop a concrete penetration resistance that is at least 4,000 psi under ASTM C403/C403M.

41-9.01C Submittals

41-9.01C(1) General

At least 15 days before delivery to the job site, submit manufacturer's recommendations, MSDS and instructions for storage and installation of joint filler material.

At least 45 days before starting ISR—RSC work submit a sample of cement from each proposed lot and samples of proposed admixtures in the quantities ordered by the Engineer.

During ISR—RSC placement operations, submit uniformity reports for hydraulic cement at least once every 30 days to the Engineer and METS, attention Cement Laboratory. Uniformity reports must comply with ASTM C917 except testing age and water content may be modified to suit the particular material.

Except for modulus of rupture tests, submit QC test result forms within 48 hours of the paving shift. Submit modulus of rupture results within:

1. 15 minutes of opening age test completion
2. 24 hours of 3-day test completion

41-9.01C(2) Quality Control Plan

If the quantity of ISR—RSC is at least 300 cu yd, submit a QC plan at least 20 days before placing trial slabs. If the quantity of ISR—RSC is less than 300 cu yd, submit proposed forms for RSC inspection, sampling, and testing.

41-9.01C(3) Mix Design

At least 10 days before use in a trial slab, submit a mix design. The maximum ambient temperature range for a mix design is 18 degrees F. Submit more than 1 mix design based on ambient temperature variations anticipated during RSC placement. Each mix design must include:

1. Mix design identification number

2. Aggregate source
3. Opening age
4. Aggregate gradation
5. Types of cement and chemical admixtures
6. Mix proportions
7. Maximum time allowed between batching and placing
8. Range of effective ambient temperatures
9. Time of final setting
10. Modulus of rupture development data from laboratory-prepared samples, including tests at:
 - 10.1. 1 hour before opening age
 - 10.2. Opening age
 - 10.3. 1 hour after opening age
 - 10.4. 1 day
 - 10.5. 3 days
 - 10.6. 7 days
 - 10.7. 28 days
11. Shrinkage test data
12. Any special instructions or conditions such as water temperature requirements

41-9.01C(4) Reserved

41-9.01D Quality Control and Assurance

41-9.01D(1) General

Designate a QC manager and assistant QC managers to administer the QC plan. The QC managers must hold current American Concrete Institute (ACI) certification as a Concrete Field Testing Technician-Grade I and a Concrete Laboratory Testing Technician-Grade II, except the assistant QC managers may hold Concrete Laboratory Testing Technician-Grade I instead of Grade II.

The QC manager responsible for the production period involved must review and sign the sampling, inspection, and test reports before submitting them. The QC manager must be present for:

1. Each stage of mix design
2. Trial slab construction
3. Production and construction of RSC
4. Meetings with the Engineer relating to production, placement, or testing

The QC manager must not be a member of this project's production or paving crews, an inspector, or a tester. The QC manager must have no duties during the production and placement of RSC except those specified.

Testing laboratories and equipment must comply with the Department's Independent Assurance Program. At the time of the QC plan submittal, the Department evaluates the quality control samplers and testers.

41-9.01D(2) Just-in-time Training

Reserved

41-9.01D(3) Quality Control Plan

Establish, implement, and maintain a QC plan for pavement. The QC plan must describe the organization and procedures used to:

1. Control the production process
2. Determine if a change to the production process is needed
3. Implement a change

The QC plan must include:

1. Names, qualifications, and certifications of QC personnel, including:
 - 1.1. QC manager
 - 1.2. Assistant QC managers
 - 1.3. Samplers and testers
2. Outline of procedure for the production, transportation, placement, and finishing of RSC

3. Outline of procedure and forms for concrete QC, sampling, and testing to be performed during and after RSC construction, including testing frequencies for modulus of rupture
4. Contingency plan for identifying and correcting problems in production, transportation, placement, or finishing RSC including:
 - 4.1. Action limits
 - 4.2. Suspension limits that do not exceed specified material requirements
 - 4.3. Detailed corrective action if limits are exceeded
 - 4.4. Temporary pavement structure provisions, including:
 - 4.4.1. The quantity and location of standby material
 - 4.4.2. Determination of need
5. Location of your quality control testing laboratory and testing equipment during and after paving operations
6. List of the testing equipment to be used, including the date of last calibration
7. Production target values for material properties that impact concrete quality or strength including cleanness value and sand equivalent
8. Outline procedure for placing and testing trial slabs, including:
 - 8.1. Locations and times
 - 8.2. Production procedures
 - 8.3. Placing and finishing methods
 - 8.4. Sampling methods, sample curing, and sample transportation
 - 8.5. Testing and test result reporting
9. Name of source plant with approved Material Plant Quality Program (MPQP)
10. Procedures or methods for controlling pavement quality including:
 - 10.1. Materials quality
 - 10.2. Contraction and construction joints
 - 10.3. Protecting pavement before opening to traffic

41-9.01D(4) Prepaving Conference

Schedule a prepaving conference and provide a facility to meet with the Engineer.

Prepaving conference attendees must sign an attendance sheet provided by the Engineer. The prepaving conference must be attended by your:

1. Project superintendent
2. Project manager
3. QC manager
4. Workers and your subcontractor's workers, including:
 - 4.1. Foremen
 - 4.2. Concrete plant manager
 - 4.3. Concrete plant operator
 - 4.4. Concrete plant inspectors
 - 4.5. Personnel performing saw cutting and joint sealing
 - 4.6. Paving machine operators
 - 4.7. Inspectors
 - 4.8. Samplers
 - 4.9. Testers

The purpose of the prepaving conference is to familiarize personnel with the project's specifications. Discuss the QC plan and processes for constructing each item of work, including:

1. Production
2. Transportation
3. Trial slabs
4. Pavement structure removal
5. Placement
6. Contingency plan
7. Sampling
8. Testing
9. Acceptance

Do not start trial slabs or paving activities until the listed personnel have attended the prepaving conference.

41-9.01D(5) Trial Slabs

Before starting individual slab replacement work, complete 1 trial slab for each mix design.

Place trial slabs near the job site at a mutually-agreed location that is neither on the roadway nor within the project limits. Trial slabs must be 10 by 20 feet and at least 10 inches thick.

During trial slab construction, sample and split the aggregate for grading, cleanness value, and sand equivalent testing.

Fabricate and test beams under California Test 524 to determine the modulus of rupture values.

Cure beams fabricated for early age testing such that the monitored temperatures in the beams and the slab are always within 5 degrees F of each other.

Monitor and record the internal temperatures of trial slabs 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 2 degrees 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 3-day testing under California Test 524 except place them into sand at a time that is from 5 to 10 times the time of final setting measured under ASTM C403/403M or 24 hours, whichever is earlier.

Trial slabs must have an opening age modulus of rupture of not less than 400 psi and a 3-day modulus of rupture of not less than 600 psi.

After authorization, remove and dispose of trial slabs and testing materials.

41-9.01D(6) Quality Control Testing

41-9.01D(6)(a) General

Provide continuous process control and quality control sampling and testing throughout RSC production and placement. Notify the Engineer at least 2 business days notice before any sampling and testing. Establish a testing facility at the job site or at an authorized location.

Sample under California Test 125.

During ISR—RSC placement, sample and fabricate beams for modulus of rupture testing within the first 30 cubic yards, at least once every 130 cu yd, and within the final truckload. Submit split samples and fabricate test beams for the Department's testing unless the Engineer informs you otherwise.

Determine the modulus of rupture at opening age under California Test 524, except beam specimens may be fabricated using an internal vibrator under ASTM C 31. Cure beams under the same conditions as the pavement until 1 hour before testing. Test 3 beam specimens in the presence of the Engineer and average the results. A single test represents no more than that day's production or 130 cu yd, whichever is less.

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 time of final setting under ASTM C403/C403M or 24 hours, whichever is earlier.

41-9.01D(6)(b) Rapid Strength Concrete

Your quality control must include testing RSC for the properties at the frequencies shown in the following table:

RSC Minimum Quality Control

Property	Test method	Minimum testing frequency ^a
Cleanness value	California Test 227	650 cu yd or 1 per shift
Sand equivalent	California Test 217	650 cu yd or 1 per shift
Aggregate gradation	California Test 202	650 cu yd or 1 per shift
Air content	California Test 504	130 cu yd or 2 per shift
Yield	California Test 518	2 per shift
Slump or penetration	ASTM C143 or California Test 533	1 per 2 hours of paving
Unit weight	California Test 518	650 cubic yards or 2 per shift
Aggregate Moisture Meter Calibration ^b	California Test 223 or California Test 226	1 per shift
Modulus of rupture	California Test 524	Comply with section 41-9.01D(6)(a)

^aTest at the most frequent interval.

^bCheck calibration of the plant moisture meter by comparing moisture meter readings with California Test 223 or California Test 226 test results

Maintain control charts to identify potential problems and 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 air content control charts, the action limit is ± 1.0 percent and the suspension limit is ± 1.5 percent of the specified values. If no value is specified, apply the air content value used in the approved mix design.

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 individual penetration or air content measurements:
 - 2.1. One point falls outside the suspension limit line
 - 2.2. Two points in a row fall outside the action limit line

Stop production and take corrective action for out of control processes or the Engineer rejects subsequent RSC.

Before each day's concrete pavement placement and at intervals not to exceed 4 hours of production, use a tachometer to test and record vibration frequency for concrete consolidation vibrators.

41-9.01D(6)(c) Reserved**41-9.01D(7) Acceptance Criteria****41-9.01D(7)(a) General**

The final texture of ISR—RSC must pass visual inspection and have a coefficient of friction of at least 0.30 determined under California Test 342.

Allow at least 25 days for the Department to schedule testing for coefficient of friction. Notify the Engineer when the pavement is scheduled to be opened to traffic.

41-9.01D(7)(b) Modulus of Rupture

ISR—RSC is accepted based on your testing for modulus of rupture at opening age and the Department's testing for modulus of rupture at 3 days.

ISR—RSC must have a modulus of rupture at opening age that is at least 400 psi and a modulus of rupture at 3 days that is at least 600 psi.

Calculate the test result as the average from testing 3 beams for each sample. The test result represents 1 paving shift or 130 cu yd, whichever is less.

41-9.01D(7)(c) Concrete Pavement Smoothness

The Department tests for concrete pavement smoothness using a 12-foot straightedge. Straightedge smoothness specifications do not apply to the pavement surface placed within 12 inches of existing concrete pavement except parallel to the centerline at the midpoint of a transverse construction joint.

The concrete pavement surface must not vary from the lower edge of a 12-foot straightedge by more than:

1. 0.01 feet when parallel to the centerline
2. 0.02 feet when perpendicular to the centerline extending from edge to edge of a traffic lane

41-9.01D(7)(d) Cracking and Raveling

The Engineer rejects an ISR—RSC slab under section 6-3.06 if within 1 year of contract acceptance there is either:

1. Partial or full-depth cracking
2. Concrete raveling consisting of either:
 - 2.1. Combined raveled areas more than 5 percent of each ISR—RSC slab area
 - 2.2. Any single raveled area of more than 4 sq ft

41-9.01D(8) Reserved**41-9.02 MATERIALS****41-9.02A General**

Reserved

41-9.02B Rapid Strength Concrete

RSC for ISR—RSC must comply with section 90-3.

Use either the 1-1/2 inch maximum or the 1-inch maximum combined grading specified in section 90-1.02C(4)(d).

Air content must comply with the minimum requirements in section 40-1.02B(4).

41-9.02C Base Bond Breaker

Use base bond breaker no. 3, 4, or 5 under section 36-2.

41-9.02D Reserved

41-9.03 CONSTRUCTION

41-9.03A General

Complete ISR—RSC adjacent to new pavement or existing pavement shown for construction as a 1st order of work. Replace individual slabs damaged during construction before placing final pavement delineation.

41-9.03B Removing Existing Pavement

Remove pavement under section 15-2.02. The Engineer determines the exact ISR—RSC limits after overlying layers are removed.

After removing pavement to the depth shown, grade to a uniform plane. Water as needed and compact the material remaining in place to a firm and stable base. The finished surface of the remaining material must not extend above the grade established by the Engineer.

41-9.03C Drill and Bond Dowel Bars

Drill existing concrete and bond dowel bars under section 41-10 if described. Do not install dowel bars in contraction joints.

41-9.03D Base Bond Breaker

Place base bond breaker before placing ISR—RSC. Comply with section 36-2.

41-9.03E Placing Rapid Strength Concrete

Do not place RSC if the ambient air temperature is forecast by the National Weather Service to be less than 40 degrees F within 72 hours of final finishing.

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 full depth of pavement to the top of the base layer. 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.

Use metal or wood side forms. Wood side forms must not be less than 1-1/2 inches thick. Side forms and connections must be of sufficient rigidity that movement will not occur under forces from equipment or RSC. Clean and oil side forms before each use. Side forms must remain in place until the pavement edge no longer requires the protection of forms.

After you place RSC, consolidate it using high-frequency internal vibrators 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 concrete pavement.

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. You may request authorization to use surface finishing additives. Submit the manufacturer's instructions with your request.

Place consecutive concrete loads without interruption. Do not allow cold joints where a visible lineation forms after concrete is placed, sets, and hardens before additional concrete placed.

Where the existing transverse joint spacing in an adjacent lane exceeds 15 feet, construct an additional transverse contraction joint midway between the existing joints. Complete sawing of contraction joints within 2 hours of completion of final finishing.

Cut contraction joints a minimum of 1/3 the slab depth.

41-9.03F Final Finishing

After preliminary finishing, round the edges of the initial paving width to a 0.04-foot radius. Round transverse and longitudinal construction joints to a 0.02-foot radius. Mark each ISR—RSC area with a stamp. The stamp mark must show the month, day, and year of placement and contract number. Level the location of the stamp with a steel trowel below the pavement texture. Orient the stamp mark so it can be read from the outside edge of ISR—RSC.

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.

Tines must be from 3/32 to 1/8 inch wide on 3/4-inch centers and have enough length, thickness, and resilience to form grooves from 1/8 to 3/16 inch deep after the concrete has hardened. Grooves must extend over the entire pavement width except do not construct grooves 3 inches from longitudinal pavement edges or joints.

Final texture must be uniform and smooth. Grooves must be parallel and aligned to the pavement edge across the pavement width. The groove alignment must not vary more than 0.1 foot for every 12 foot length.

Protect RSC under section 90-1.03C.

41-9.03G Temporary Pavement Structure

Temporary pavement structure must be RSC or 3-1/2 inch thick HMA over aggregate base.

41-9.03H Noncompliant Individual Slab Replacement

Replace an ISR—RSC slab with any of the following:

1. One or more full-depth cracks.
2. Concrete raveling.
3. Noncompliant smoothness except you may request authorization for grinding under section 42 and retesting. Grinding that causes a depression will not be considered. Smoothness must be corrected within 48 hours of placing ISR—RSC.
4. Noncompliant modulus of rupture.

If the modulus of rupture at opening age is at least 400 psi and the modulus of rupture at 3 days is at least 500 psi but less than 600 psi, you may request authorization to leave the ISR—RSC in place and accept the specified deduction.

If pavement is noncompliant for coefficient of friction, groove or grind the pavement under section 42. Comply with section 40-1.03Q(4) and groove or grind before the installation of any required joint seal or edge drains adjacent to the areas to the noncompliant area.

If an ISR—RSC slab has partial depth cracking, treat it with high-molecular-weight methacrylate under section 41-3.

41-9.03I Replace Pavement Delineation

Replace traffic stripes, pavement markings, and markers that are removed, obliterated, or damaged by ISR—RSC under sections 84 and 85.

41-9.03J Reserved

41-9.04 PAYMENT

Replace base is not included in the payment for individual slab replacement (RSC).

Drill and bond dowel bars are not included in payment for individual slab replacement (RSC).

For individual slab replacement (RSC) with a modulus of rupture at opening age that is at least 400 psi and a modulus of rupture at 3 days that is greater than or equal to 500 psi but less than 550 psi, the Department deducts 10 percent of the payment for individual slab replacement (RSC).

For individual slab replacement (RSC) with a modulus of rupture at opening age that is at least 400 psi and a modulus of rupture at 3 days that is greater than or equal to 550 psi but less than 600 psi, the Department deducts 5 percent of the payment for individual slab replacement (RSC).

41-10 DRILL AND BOND BARS

41-10.01 GENERAL

41-10.01A Summary

Section 41-10 includes specifications for drilling, installing, and bonding tie bars and dowel bars in concrete pavement.

41-10.01B Definitions

Reserved

41-10.01C Submittals

Submit a certificate of compliance for:

1. Tie bars
2. Dowel bars
3. Dowel bar lubricant
4. Chemical adhesive
5. Epoxy powder coating

At least 15 days before delivery to the job site, submit the manufacturer's recommendations and instructions for storage, handling, and use of chemical adhesive.

41-10.01D Quality Control and Assurance

41-10.01D(1) General

Drill and bond bar is accepted based on inspection before concrete placement.

41-10.01D(2) Reserved

41-10.02 MATERIALS

41-10.02A General

Dowel bar lubricant must comply with section 40-1.02D.

Chemical adhesive for drilling and bonding bars must be on the Authorized Material List. The Authorized Material List indicates the appropriate chemical adhesive system for concrete temperature and installation conditions.

Each chemical adhesive system container must clearly and permanently show the following:

1. Manufacturer's name
2. Model number of the system
3. Manufacture date
4. Batch number
5. Expiration date
6. Current International Conference of Building Officials Evaluation Report number
7. Directions for use
8. Storage requirement
9. Warnings or precautions required by state and federal laws and regulations

41-10.02B Reserved

41-10.03 CONSTRUCTION

41-10.03A General

Drill holes for bars. Clean drilled holes in compliance with the chemical adhesive manufacturer's instructions. Holes must be dry at the time of placing the chemical adhesive and bars. Use a grout retention ring when drilling and bonding dowel bars. Immediately after inserting the bar into the chemical adhesive, support the bar to prevent movement until chemical adhesive has cured the minimum time recommended by the manufacturer.

Apply dowel bar lubricant to the entire exposed portion of the dowel bar.

If the Engineer rejects a bar installation: stop paving, drilling, and bonding activities. Adjust your procedures and obtain the Engineer's verbal authorization before resuming paving, drilling, and bonding.

42-3.03 CONSTRUCTION

42-3.03A General

Grind surfaces in the longitudinal direction of the traveled way and grind the full lane width. Begin and end grinding at lines perpendicular to the roadway centerline.

Grinding must result in a parallel corduroy texture with grooves from 0.08 to 0.12 inch wide and from 55 to 60 grooves per foot of width. Grooves must be from 0.06 to 0.08 inch from the top of the ridge to the bottom of the groove.

Grind with abrasive grinding equipment using diamond cutting blades mounted on a self-propelled machine designed for grinding and texturing concrete pavements.

42-3.03B Pavement

Grind existing concrete pavement that is adjacent to an individual slab replacement. Grind the replaced individual slab and all the existing slabs immediately surrounding it. Grind after the individual slab is replaced.

Grind existing concrete pavement that is adjacent to new lanes of concrete pavement. Grind before paving.

After grinding, the existing pavement must comply with requirements for smoothness and coefficient of friction in section 40 except:

1. At the midpoint of a joint or crack, test smoothness with a straightedge. Both sides must have uniform texture.
2. Straightedge and inertial profiler requirements do not apply to areas abnormally depressed from subsidence or other localized causes. End smoothness testing 15 feet before and resume 15 feet after these areas.
3. Cross-slope must be uniform and have positive drainage across the traveled way and shoulder.

As an alternative to grinding existing concrete pavement, you may replace the existing pavement. The new concrete pavement must be the same thickness as the removed pavement. Replace existing pavement between longitudinal joints or pavement edges and transverse joints. Do not remove portions of slabs.

Replacement of existing concrete pavement must comply with requirements for individual slab replacement in section 41-9.

42-3.03C Bridge Decks, Approach Slabs, and Approach Pavement

Grind bridge decks, approach slabs, and approach pavement only if described.

The following ground areas must comply with the specifications for smoothness and concrete cover over reinforcing steel in section 51-1.01D(4):

1. Bridge decks
2. Approach slabs
3. Adjacent 50 feet of approach pavement

After grinding, the coefficient of friction must comply with section 51-1.01D(4).

42-3.04 PAYMENT

Grinding existing approach slabs and adjacent 50 feet of approach pavement is paid for as grind existing bridge deck.

The Department does not pay for grinding replacement concrete pavement or for additional grinding to comply with smoothness requirements.

Add to section 42:

07-19-13

42-4-42-9 RESERVED

AA

**DIVISION VI STRUCTURES
46 GROUND ANCHORS AND SOIL NAILS**

07-19-13

Replace the 1st paragraph of section 46-1.01C(2) with:

04-19-13

Submit 5 copies of shop drawings to OSD, Documents Unit. Notify the Engineer of the submittal. Include in the notification the date and contents of the submittal. Allow 30 days for the Department's review. After review, submit from 6 to 12 copies, as requested, for authorization and use during construction.

Shop drawings and calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State.

Replace the 3rd paragraph of section 46-1.01C(2) with:

01-18-13

Ground anchor shop drawings must include:

1. Details and specifications for the anchorage system and ground anchors.
2. Details for the transition between the corrugated plastic sheathing and the anchorage assembly.
3. If shims are used during lock-off, shim thickness and supporting calculations.
4. Calculations for determining the bonded length. Do not rely on any capacity from the grout-to-ground bond within the unbonded length.

01-18-13

Delete the 5th and 6th paragraphs of section 46-1.01C(2).

Replace the 4th paragraph of section 46-1.01D(2)(b) with:

01-18-13

Each jack and its gage must be calibrated as a unit under the specifications for jacks used to tension prestressing steel permanently anchored at 25 percent or more of its specified minimum ultimate tensile strength in section 50-1.01D(3).

Replace the 3rd paragraph of section 46-1.01D(2)(d) with:

07-19-13

The Department may verify the test loads using the Department's load cells. If requested, install and support the Department's testing equipment during testing and remove the equipment after testing is complete.

Add to section 46-1.02:

07-19-13

46-1.02C Grout

Grout must consist of cement and water and may contain an admixture if authorized. Cement must comply with section 90-1.02B(2). Water must comply with section 90-1.02D. Admixtures must comply with

section 90, except they must not contain chloride ions in excess of 0.25 percent by weight. Do not exceed 5 gallons of water per 94 lb of cement.

Mix the grout as follows:

1. Add water to the mixer followed by cement and any admixtures or fine aggregate.
2. Mix the grout with mechanical mixing equipment that produces a uniform and thoroughly mixed grout.
3. Agitate the grout continuously until the grout is pumped.
4. Do not add water after the initial mixing.

Add to section 46-1.03B:

04-20-12

Dispose of drill cuttings under section 19-2.03B.

Add to the end of section 46-1.03C:

07-19-13

Grouting equipment must be:

1. Capable of grouting at a pressure of at least 100 psi
2. Equipped with a pressure gage having a full-scale reading of not more than 300 psi

Delete the 3rd paragraph of section 46-2.01A.

07-19-13

Add to the beginning of section 46-2.01C:

07-19-13

Submittals for strand tendons, bar tendons, bar couplers, and anchorage assemblies must comply with section 50-1.01C.

Add to section 46-2.01D:

07-19-13

46-2.01D(3) Steel

Strand tendons, bar tendons, bar couplers, and anchorage assemblies must comply with section 50-1.01D.

46-2.01D(4) Grout

The Department tests the efflux time of the grout under California Test 541.

Add to the beginning of section 46-2.02B:

07-19-13

Strand tendons, bar tendons, and bar couplers must comply with section 50-1.02B.

Replace the 1st paragraph of section 46-2.02E with:

07-19-13

The efflux time of the grout immediately after mixing must be at least 11 seconds.

Replace the 1st paragraph of section 47-2.02E with:

02-17-12

Steel wire must comply with ASTM A 82/A 82M. Welded wire reinforcement must comply with ASTM A 185/A 185M.

Replace section 47-3 with:

07-19-13

47-3 REINFORCED CONCRETE CRIB WALLS

47-3.01 General

Section 47-3 includes specifications for constructing reinforced concrete crib walls.

Reinforced concrete crib walls must comply with section 51.

Reinforcement must comply with section 52.

Concrete crib walls consist of a series of rectangular cells composed of interlocking, precast, reinforced concrete headers, stretchers, and blocks.

47-3.02 Materials

47-3.02A General

Pads shown to be placed between bearing surfaces must either be (1) neoprene complying with the specifications for strip waterstops in section 51-2.05 or (2) commercial quality no. 30 asphalt felt. The protective board is not required for neoprene pads.

47-3.02B Crib Members

47-3.02B(1) General

All members may be manufactured to dimensions 1/8 inch greater in thickness than shown. The thickness of the lowest step must not be less than the dimension shown.

Stretchers may be manufactured 1/2 inch less in length than shown.

When an opening is shown in the face of the wall, special length stretchers and additional headers may be necessary.

For non-tangent wall alignments, special length stretchers may be required.

For non-tangent wall alignments and at locations where filler blocks are required, special length front face closure members may be required.

47-3.02B(2) Reinforcement

Reinforcing wire must comply with ASTM A 496/A 496M.

For hoops or stirrups use either (1) reinforcing wire or (2) deformed steel welded wire reinforcement. The size must be equivalent to the reinforcing steel shown. Deformed steel welded wire reinforcement must comply with ASTM A 497/A 497M.

47-3.02B(3) Concrete

Concrete test cylinders must comply with section 90-1.01D(5), except when the penetration of fresh concrete is less than 1 inch, the concrete in the test mold must be consolidated by vibrating the mold equivalent to the consolidating effort being used to consolidate the concrete in the members.

Cure crib members under section 51-4.02C.

When removed from forms, the members must present a true surface of even texture, free from honeycombs and voids larger than 1 inch in diameter and 5/16 inch in depth. Clean and fill other pockets with mortar under sections 51-1.02F and 51-1.03E(2).

External vibration resulting in adequate consolidation may be used.

If the Engineer determines that rock pockets are of the extent or character as to affect the strength of the member or to endanger the life of the steel reinforcement, replace the member.

Finish concrete-to-concrete bearing surfaces to a smooth plane. Section 51-1.03F does not apply to concrete crib members.

47-3.03 Construction

Place reinforced concrete crib walls to the lines and grades established by the Engineer. The foundation must be accepted by the Engineer before any crib members are placed.

The gap between bearing surfaces must not exceed 1/8 inch.

Where a gap of 1/16 inch to 1/8 inch exists or where shown, place a 1/16-inch pad of asphalt felt or sheet neoprene between the bearing surfaces.

47-3.04 Payment

The area of reinforced concrete crib wall is measured on the batter at the outer face for the height from the bottom of the bottom stretcher to the top of the top stretcher and for a length measured from end to end of each section of wall.

Add between the 3rd and 4th paragraphs of section 47-5.01:

Reinforcement must comply with section 52.

10-19-12

Add to section 47-6.01A:

The alternative earth retaining system must comply with the specifications for the type of wall being constructed.

10-19-12

Replace "sets" at each occurrence in the 1st paragraph of section 47-6.01C with:

copies

04-19-13

AA

48 TEMPORARY STRUCTURES

07-19-13

Replace "previously welded splice" and its definition in section 48-2.01B with:

previously welded splice: Splice made in a falsework member in compliance with AWS D1.1 or other recognized welding standard before contract award.

04-19-13

Add to section 48-2.01B:

independent support system: Support system that is in addition to the falsework removal system employing methods of holding falsework from above by winches, hydraulic jacks with prestressing steel, HS rods, or cranes.

07-19-13

Delete "field" in the 1st sentence of the 5th paragraph of section 48-2.01C(1).

04-19-13

Replace item 1 in the list in the 6th paragraph of section 48-2.01C(1) with:

04-19-13

1. Itemize the testing, inspection methods, and acceptance criteria used

Replace "sets" at each occurrence in the 4th paragraph of section 48-2.01C(2) with:

07-19-13

copies

Replace the 7th paragraph of section 48-2.01C(2) with:

09-16-11

If you submit multiple submittals at the same time or additional submittals before review of a previous submittal is complete:

1. You must designate a review sequence for submittals
2. Review time for any submittal is the review time specified plus 15 days for each submittal of higher priority still under review

Add to section 48-2.01C(2):

07-19-13

Shop drawings and calculations for falsework removal systems employing methods of holding falsework from above by winches, hydraulic jacks with prestressing steel, HS rods, or cranes must include:

1. Design code used for the analysis of the structural members of the independent support system
2. Provisions for complying with current Cal/OSHA requirements
3. Load tests and ratings within 1 year of intended use of hydraulic jacks and winches
4. Location of the winches, hydraulic jacks with prestressing steel, HS rods, or cranes
5. Analysis showing that the bridge deck and overhang are capable of supporting all loads at all time
6. Analysis showing that winches will not overturn or slide during all stages of loading
7. Location of deck and soffit openings if needed
8. Details of repair for the deck and soffit openings after falsework removal

Replace the 1st paragraph of section 48-2.01D(2) with:

04-19-13

Welding must comply with AWS D1.1 or other recognized welding standard, except for fillet welds where the load demands are 1,000 lb or less per inch for each 1/8 inch of fillet weld.

Replace the 1st through 3rd sentences in the 2nd paragraph of section 48-2.01D(2) with:

04-19-13

Perform NDT on welded splices using UT or RT. Each weld and any repair made to a previously welded splice must be tested.

Replace the 3rd paragraph of section 48-2.01D(2) with:

04-19-13

For previously welded splices, perform and document all necessary testing and inspection required to certify the ability of the falsework members to sustain the design stresses.

Add to section 48-2.01D(3)(a):

07-19-13

Falsework removal system employing methods of holding falsework from above and members of the independent support system must support the sum of the actual vertical and horizontal loads due to falsework materials, equipment, construction sequence or other causes, and wind loading. Identifiable mechanical devices used in the falsework removal plan must meet applicable industry standards and manufacturer instructions for safe load carrying capacity. Unidentifiable winches must be capable of carrying twice the design load.

The load used for the analysis of overturning moment and sliding of the winch system must be 150 percent of the design load.

Add to section 48-2.03D:

07-19-13

Falsework removal employing methods of holding falsework by winches, hydraulic jacks with prestressing steel, HS rods, or cranes must also be supported by an independent support system when the system is not actively lowering the falsework at vehicular, pedestrian, or railroad traffic openings.

Bridge deck openings used to facilitate falsework removal activities must be formed and located away from the wheel path. The formed openings must be wedge shaped with a 5-inch maximum diameter at the top and a 3-inch maximum diameter at the bottom.

Anchor 10-inch-square aluminum or galvanized steel wire, 1/4-inch-mesh hardware cloth with a 0.025-inch minimum wire diameter firmly to the inside of the soffit openings. Construct a 1/2-inch drip groove to the outside of soffit openings.

Clean and roughen openings made in the bridge deck. Fill the deck openings with rapid setting concrete complying with section 15-5.02.

AA

49 PILING

07-19-13

Replace "sets" in the 1st paragraph of section 49-1.01C(2) with:

copies

04-19-13

Replace "set" in the 2nd paragraph of section 49-1.01C(2) with:

copy

04-19-13

Replace "Load Applied to Pile by Hydraulic Jack(s) Acting at One End of Test Beam(s) Anchored to the Pile" in the 5th paragraph of section 49-1.01D(2) with:

"Tensile Load Applied by Hydraulic Jack(s) Acting Upward at One End of Test Beam(s)"

07-20-12

Add to section 49-1.03:

Dispose of drill cuttings under section 19-2.03B.

04-20-12

Replace the paragraph of section 49-2.01A(1) with:

07-19-13

Section 49-2.01 includes general specifications for fabricating and installing driven piles.
Epoxy-coated bar reinforcing steel used for pile anchors must comply with section 52-2.02.

Replace the 2nd paragraph of section 49-2.01D with:

01-20-12

Furnish piling is measured along the longest side of the pile from the specified tip elevation shown to the plane of pile cutoff.

Replace the paragraph of section 49-2.02A(1) with:

07-19-13

Section 49-2.02 includes specifications for fabricating and installing steel pipe piles.

Replace the definitions in section 49-2.02A(2) with:

07-19-13

shop welding: Welding performed at a plant on the Department's Authorized Facility Audit List.

field welding: Welding not performed at a plant on the Department's Authorized Facility Audit List.

Replace item 2 in the list in the paragraph of section 49-2.02A(3)(b) with:

07-19-13

2. Certified mill test reports for each heat number of steel used in pipe piles being furnished.

Replace the paragraph of section 49-2.02A(4)(a) with:

07-19-13

Section 11-3.02 does not apply to shop welds in steel pipe piles fabricated at a facility on the Department's Authorized Facility Audit List.

For groove welds using submerged arc welding from both sides without backgouging, qualify the WPS under Table 4.5 of AWS D1.1.

Replace "0.45" in the 2nd paragraph of section 49-2.02B(1)(a) with:

07-19-13

0.47

Replace the 1st paragraph of section 49-2.02B(1)(b) with:

07-19-13

Welds must comply with AWS D1.1. Circumferential welds must be CJP welds.

Delete the 5th paragraph of section 49-2.02B(1)(b).

07-19-13

Add to section 49-2.02B(1):

07-19-13

49-2.02B(1)(d) Reserved

Replace "4.8.4" in item 2.3 in the list in the 2nd paragraph of section 49-2.02B(2) with:

07-19-13

4.9.4

Delete the 3rd paragraph of section 49-2.02C(2).

07-19-13

Replace the paragraph of section 49-2.03A(1) with:

07-19-13

Section 49-2.03 includes specifications for fabricating and installing structural shape steel piles.

Replace the paragraph of section 49-2.03A(3) with:

07-19-13

Submit a certified material test report and a certificate of compliance that includes a statement that all materials and workmanship incorporated in the work and all required tests and inspections of this work have been performed as described.

Replace the 1st paragraph of section 49-2.03B with:

07-19-13

Structural shape steel piles must comply with ASTM A 36/A 36M, ASTM A 572/A 572M, ASTM A 709/A 709M, or ASTM A 992/A 992M.

Replace "sets" in the 1st paragraph of section 49-2.04A(3) with:

04-19-13

copies

Delete the 1st paragraph of section 49-2.04A(4).

07-19-13

Replace the 3rd and 4th paragraphs of section 49-2.04B(2) with:

10-19-12

Piles in a corrosive environment must be steam or water cured under section 90-4.03.

If piles in a corrosive environment are steam cured, either:

1. Keep the piles continuously wet for at least 3 days. The 3 days includes the holding and steam curing periods.
2. Apply curing compound under section 90-1.03B(3) after steam curing.

Replace the 1st paragraph of section 49-3.01A with:

07-19-13

Section 49-3.01 includes general specifications for constructing CIP concrete piles.

Add to section 49-3.01A:

01-20-12

Concrete must comply with section 51.

Replace the 1st paragraph of section 49-3.01C with:

01-20-12

Except for CIDH concrete piles constructed under slurry, construct CIP concrete piles such that the excavation methods and the concrete placement procedures provide for placing the concrete against undisturbed material in a dry or dewatered hole.

Replace "Reserved" in section 49-3.02A(2) with:

01-20-12

dry hole:

1. Except for CIDH concrete piles specified as end bearing, a drilled hole that:
 - 1.1. Accumulates no more than 12 inches of water in the bottom of the drilled hole during a period of 1 hour without any pumping from the hole during the hour.
 - 1.2. Has no more than 3 inches of water in the bottom of the drilled hole immediately before placing concrete.
2. For CIDH concrete piles specified as end bearing, a drilled hole free of water without the use of pumps.

Replace "Reserved" in section 49-3.02A(3)(a) with:

01-20-12

If plastic spacers are proposed for use, submit the manufacturer's data and a sample of the plastic spacer. Allow 10 days for review.

Replace item 5 in the list in the 1st paragraph of section 49-3.02A(3)(b) with:

10-19-12

5. Methods and equipment for determining:
 - 5.1. Depth of concrete
 - 5.2. Theoretical volume of concrete to be placed, including the effects on volume if casings are withdrawn
 - 5.3. Actual volume of concrete placed

Add to the list in the 1st paragraph of section 49-3.02A(3)(b):

01-18-13

8. Drilling sequence and concrete placement plan.

Replace item 2 in the list in the 1st paragraph of section 49-3.02A(3)(g) with:

01-20-12

2. Be sealed and signed by an engineer who is registered as a civil engineer in the State. This requirement is waived for either of the following conditions:
 - 2.1. The proposed mitigation will be performed under the current Department-published version of *ADSC Standard Mitigation Plan 'A' - Basic Repair* without exception or modification.
 - 2.2. The Engineer determines that the rejected pile does not require mitigation due to structural, geotechnical, or corrosion concerns, and you elect to repair the pile using the current

Department-published version of *ADSC Standard Mitigation Plan 'B' - Grouting Repair* without exception or modification.

Replace "49-2.03A(4)(d)" in the 1st paragraph of section 49-3.02A(4)(d)(i) with:

07-19-13

49-3.02A(4)(d)

Add to the beginning of section 49-3.02A(4)(d)(ii):

07-19-13

If the drilled hole is dry or dewatered without the use of temporary casing to control ground water, installation of inspection pipes is not required.

Replace item 1 in the list in the 1st paragraph of section 49-3.02A(4)(d)(ii) with:

01-20-12

1. Inspection pipes must be schedule 40 PVC pipe complying with ASTM D 1785 with a nominal pipe size of 2 inches. Watertight PVC couplers complying with ASTM D 2466 are allowed to facilitate pipe lengths in excess of those commercially available. Log the location of the inspection pipe couplers with respect to the plane of pile cutoff.

Add to section 49-3.02A(4)(d)(iv):

01-20-12

If the Engineer determines it is not feasible to use one of ADSC's standard mitigation plans to mitigate the pile, schedule a meeting and meet with the Engineer before submitting a nonstandard mitigation plan.

The meeting attendees must include your representatives and the Engineer's representatives involved in the pile mitigation. The purpose of the meeting is to discuss the type of pile mitigation acceptable to the Department.

Provide the meeting facility. The Engineer conducts the meeting.

Replace the 1st paragraph of section 49-3.02B(5) with:

07-19-13

Grout must consist of cementitious material and water, and may contain an admixture if authorized. Do not exceed 5 gallons of water per 94 lb of cement.

Cementitious material must comply with section 90-1.02B, except SCMs are not required.

Water must comply with section 90-1.02D. If municipally supplied potable water is used, the testing specified in section 90-1.02D is waived.

Admixtures must comply with section 90, except admixtures must not contain chloride ions in excess of 0.25 percent by weight.

Use aggregate to extend the grout as follows:

1. Aggregate must consist of at least 70 percent fine aggregate and approximately 30 percent pea gravel, by weight.
2. Fine aggregate must comply with section 90-1.02C(3).
3. Size of pea gravel must be such that 100 percent passes the 1/2-inch sieve, at least 85 percent passes the 3/8-inch sieve, and not more than 5 percent passes the no. 8 sieve.
4. Minimum cementitious material content of the grout must not be less than 845 lb/cu yd of grout.

Mix the grout as follows:

1. Add water to the mixer followed by cementitious material, aggregates, and any admixtures.
2. Mix the grout with mechanical mixing equipment that produces a uniform and thoroughly mixed grout.
3. Agitate the grout continuously until the grout is pumped.
4. Do not add water after initial mixing.

Replace section 49-3.02B(8) with:

01-20-12

49-3.02B(8) Spacers

Spacers must comply with section 52-1.03D, except you may use plastic spacers.

Plastic spacers must:

1. Comply with sections 3.4 and 3.5 of the Concrete Reinforcing Steel Institute's *Manual of Standard Practice*
2. Have at least 25 percent of their gross plane area perforated to compensate for the difference in the coefficient of thermal expansion between the plastic and concrete
3. Be of commercial quality

Add between the 1st and 2nd paragraphs of section 49-3.02C(2):

07-19-13

For CIDH concrete piles with a pile cap, the horizontal tolerance at the center of each pile at pile cut-off is the larger of 1/24 of the pile diameter or 3 inches. The horizontal tolerance for the center-to-center spacing of 2 adjacent piles is the larger of 1/24 of the pile diameter or 3 inches.

Add to section 49-3.02C(4):

01-20-12

Unless otherwise shown, the bar reinforcing steel cage must have at least 3 inches of clear cover measured from the outside of the cage to the sides of the hole or casing.

Place spacers at least 5 inches clear from any inspection tubes.

Place plastic spacers around the circumference of the cage and at intervals along the length of the cage, as recommended by the manufacturer.

07-19-13

For a single CIDH concrete pile supporting a column:

1. If the pile and the column share the same reinforcing cage diameter, this cage must be accurately placed as shown
2. If the pile reinforcing cage is larger than the column cage and the concrete is placed under dry conditions, maintain a clear horizontal distance of at least 3.5 inches between the two cages
3. If the pile reinforcing cage is larger than the column cage and the concrete is placed under slurry, maintain a clear horizontal distance of at least 5 inches between the two cages

Replace section 49-3.02C(6) with:

07-19-13

49-3.02C(6) Construction Joint

Section 49-3.02C(6) applies to CIDH concrete piles where a construction joint is shown.

If a permanent steel casing is not shown, you must furnish and install a permanent casing. The permanent casing must:

1. Be watertight and of sufficient strength to prevent damage and to withstand the loads from installation procedures, drilling and tooling equipment, lateral concrete pressures, and earth pressures.
2. Extend at least 5 feet below the construction joint. If placing casing into rock, the casing must extend at least 2 feet below the construction joint.
3. Not extend above the top of the drilled hole or final grade whichever is lower.
4. Not increase the diameter of the CIDH concrete pile more than 2 feet.
5. Be installed by impact or vibratory hammers, oscillators, rotators, or by placing in a drilled hole. Casings placed in a drilled hole must comply with section 49-3.02C(5).

Section 49-2.01A(4)(b) does not apply to permanent casings specified in this section.

Add to section 49-4.01:

Steel soldier piles must comply with section 49-2.03.

07-19-13

Replace the headings and paragraphs in section 49-4.02 with:

Concrete anchors must comply with the specifications for studs in clause 7 of AWS D1.1.

07-19-13

AA

50 PRESTRESSING CONCRETE

07-19-13

Replace "sets" at each occurrence in the 2nd and 3rd paragraphs of section 50-1.01C(3) with:

copies

04-19-13

Add to section 50-1.01C(3):

Include a grouting plan with your shop drawing submittal. The grouting plan must include:

07-19-13

1. Detailed grouting procedures
2. Type, quantity, and brand of materials to be used
3. Type of equipment to be used including provisions for backup equipment
4. Types and locations of grout inlets, outlets, and vents
5. Methods to clean ducts before grouting
6. Methods to control the rate of flow within ducts
7. Theoretical grout volume calculations for each duct
8. Duct repair procedures due to an air pressure test failure
9. Mixing and pumping procedures
10. Direction of grouting
11. Sequence of use of inlets and outlets
12. Procedure for handling blockages
13. Proposed forms for recording grouting information
14. Procedure for secondary grouting
15. Names of people who will perform grouting activities including their relevant experience and certifications

Add to section 50-1.01C:

07-19-13

50-1.01C(5) Grout

Submit a daily grouting report for each day grouting is performed. Submit the report within 3 days after grouting. The report must be signed by the technician supervising the grouting activity. The report must include:

1. Identification of each tendon
2. Date grouting occurred
3. Time the grouting started and ended
4. Date of placing the prestressing steel in the ducts
5. Date of stressing
6. Type of grout used
7. Injection end and applied grouting pressure
8. Actual and theoretical quantity of grout used to fill duct
9. Ratio of actual to theoretical grout quantity
10. Records of air, grout, and structure surface temperatures during grouting.
11. Summary of tests performed and results, except submit compressive strength and chloride ion test results within 48 hours of test completion
12. Names of personnel performing the grouting activity
13. Summary of problems encountered and corrective actions taken
14. Summary of void investigations and repairs made

Replace the introductory clause in the 1st paragraph of section 50-1.01C(4) with:

Submit test samples for the materials shown in the following table to be used in the work:

07-19-13

Add between "the" and "test samples" in the 1st paragraph of section 50-1.01D(2):

prestressing steel

07-19-13

Replace the 3rd paragraph of section 50-1.01D(2) with:

The Department may verify the prestressing force using the Department's load cells.

10-19-12

Replace the 3rd paragraph in section 50-1.01D(3) with:

Each pressure gage must be fully functional and have an accurately reading, clearly visible dial or display. The dial must be at least 6 inches in diameter and graduated in 100 psi increments or less.

07-19-13

Add between the 5th and 6th paragraphs of section 50-1.01D(3):

Each jack and its gages must be calibrated as a unit.

07-19-13

Replace the 6th paragraph in section 50-1.01D(3) with:

Each jack used to tension prestressing steel permanently anchored at 25 percent or more of its specified minimum ultimate tensile strength must be calibrated by METS within 1 year of use and after each repair. You must:

07-19-13

1. Schedule the calibration of the jacking equipment with METS
2. Mechanically calibrate the gages with a dead weight tester or other authorized means before calibration of the jacking equipment by METS
3. Verify that the jack and supporting systems are complete, with proper components, and are in good operating condition
4. Provide labor, equipment, and material to (1) install and support the jacking and calibration equipment and (2) remove the equipment after the calibration is complete
5. Plot the calibration results

Each jack used to tension prestressing steel permanently anchored at less than 25 percent of its specified minimum ultimate tensile strength must be calibrated by an authorized laboratory within 6 months of use and after each repair.

Add to section 50-1.01D:

07-19-13

50-1.01D(4) Pressure Testing Ducts

For post-tensioned concrete bridges, pressure test each duct with compressed air after stressing. To pressure test the ducts:

1. Seal all inlets, outlets, and grout caps.
2. Open all inlets and outlets on adjacent ducts.
3. Attach an air compressor to an inlet at 1 end of the duct. The attachment must include a valve that separates the duct from the air source.
4. Attach a pressure gage to the inlet at the end of the duct.
5. Pressurize the duct to 50 psi.
6. Lock-off the air source.
7. Record the pressure loss after 1 minute.
8. If there is a pressure loss exceeding 25 psi, repair the leaks with authorized methods and retest.

Compressed air used to clear and test the ducts must be clean, dry, and free of oil or contaminants.

50-1.01D(5) Duct Demonstration of Post-Tensioned Members

Before placing forms for deck slabs of box girder bridges, demonstrate that any prestressing steel placed in the ducts is free and unbonded. If no prestressing steel is in the ducts, demonstrate that the ducts are unobstructed.

If prestressing steel is installed after the concrete is placed, demonstrate that the ducts are free of water and debris immediately before installing the steel.

Before post-tensioning any member, demonstrate that the prestressing steel is free and unbonded in the duct.

The Engineer must witness all demonstrations.

50-1.01D(6) Void Investigation

In the presence of the Engineer, investigate the ducts for voids between 24 hours and 72 hours after grouting completion. As a minimum, inspect the inlet and outlet ports at the anchorages and at high points in the tendons for voids after removal. Completely fill any voids found with secondary grout.

50-1.01D(7) Personnel Qualifications

Perform post-tensioning field activities, including grouting, under the direct supervision of a technician certified as a level 2 Bonded PT Field Specialist through the Post-Tensioning Institute. Grouting activities may be performed under the direct supervision of a technician certified as a Grouting Technician through the American Segmental Bridge Institute.

Replace the 6th paragraph of section 50-1.02B with:

07-19-13

Package the prestressing steel in containers or shipping forms that protect the steel against physical damage and corrosion during shipping and storage.

Replace the 13th paragraph of section 50-1.02B with:

07-19-13

Prestressing steel is rejected if surface rust either:

1. Cannot be removed by hand-cleaning with a fine steel wool pad
2. Leaves pits visible to the unaided eye after cleaning

Replace the 4th paragraph of section 50-1.02C with:

07-19-13

Admixtures must comply with section 90, except admixtures must not contain chloride ions in excess of 0.25 percent by weight.

Delete the 5th paragraphs of section 50-1.02C.

07-19-13

Add to section 50-1.02C:

07-19-13

Secondary grout must:

1. Comply with ASTM C 1107
2. Not have a deleterious effect on the steel, concrete, or bond strength of the steel to concrete

Replace item 9 including items 9.1 and 9.2 in the list in the 1st paragraph of section 50-1.02D with:

07-19-13

9. Have an inside cross-sectional area of at least 2.5 times the net area of the prestressing steel for multistrand tendons

Replace "3/8" in item 10 in the list in the 1st paragraph of section 50-1.02D with:

07-19-13

1/2

Delete the 2nd sentences in the 1st paragraph of section 50-1.02E.

07-19-13

Replace section 50-1.02F with:

07-19-13

50-1.02F Permanent Grout Caps

Permanent grout caps for anchorage systems of post-tensioned tendons must:

1. Be glass-fiber-reinforced plastic with antioxidant additives. The environmental stress-cracking failure time must be at least 192 hours under ASTM D 1693, Condition C.

2. Completely cover and seal the wedge plate or anchorage head and all exposed metal parts of the anchorage against the bearing plate using neoprene O-ring seals.
3. Have a grout vent at the top of the cap.
4. Be bolted to the anchorage with stainless steel complying with ASTM F 593, alloy 316. All fasteners, including nuts and washers, must be alloy 316.
5. Be pressure rated at or above 150 psi.

Add to section 50-1.02:

09-16-11

50-1.02G Sheathing

Sheathing for debonding prestressing strand must:

1. Be split or un-split flexible polymer plastic tubing
2. Have a minimum wall thickness of 0.025 inch
3. Have an inside diameter exceeding the maximum outside diameter of the strand by 0.025 to 0.14 inch

Split sheathing must overlap at least 3/8 inch.

Waterproofing tape used to seal the ends of the sheathing must be flexible adhesive tape.

The sheathing and waterproof tape must not react with the concrete, coating, or steel.

Replace the 2nd paragraph of section 50-1.03A(3) with:

07-19-13

After installation, cover the duct ends and vents to prevent water or debris from entering.

Add to section 50-1.03A(3):

07-19-13

Support ducts vertically and horizontally during concrete placement at a spacing of at most 4 feet.

Delete "at least" in the 1st paragraph of section 50-1.03B(1).

07-19-13

Add to section 50-1.03B(1):

01-20-12

After seating, the maximum tensile stress in the prestressing steel must not exceed 75 percent of the minimum ultimate tensile strength shown.

Delete the 1st through 4th paragraphs of section 50-1.03B(2)(a).

07-19-13

Replace "temporary tensile strength" in the 7th paragraph of section 50-1.03B(2)(a) with:

07-19-13

temporary tensile stress

Add to section 50-1.03B(2)(a):

07-19-13

If prestressing strand is installed using the push-through method, use guide caps at the front end of each strand to protect the duct from damage.

Add to the list in the 2nd paragraph of section 50-1.03B(2)(c):

07-19-13

3. Be equipped with permanent grout caps

Replace section 50-1.03B(2)(d) with:

07-19-13

50-1.03B(2)(d) Bonding and Grouting

50-1.03B(2)(d)(i) General

Bond the post-tensioned prestressing steel to the concrete by completely filling the entire void space between the duct and the prestressing steel with grout.

Ducts, vents, and grout caps must be clean and free from water and deleterious materials that would impair bonding of the grout or interfere with grouting procedures. Compressed air used for cleaning must be clean, dry, and free of oil or contaminants.

Prevent the leakage of grout through the anchorage assembly by positive mechanical means.

Before starting daily grouting activities, drain the pump system to remove any water from the piping system.

Break down and thoroughly clean the pump and piping system after each grouting session.

After completing duct grouting activities:

1. Abrasive blast clean and expose the aggregate of concrete surfaces where concrete is to be placed to cover and encase the anchorage assemblies
2. Remove the ends of vents 1 inch below the roadway surface

50-1.03B(2)(d)(ii) Mixing and Proportioning

Proportion solids by weight to an accuracy of 2 percent.

Proportion liquids by weight or volume to an accuracy of 1 percent.

Mix the grout as follows:

1. Add water to the mixer followed by the other ingredients.
2. Mix the grout with mechanical mixing equipment that produces a uniform and thoroughly mixed grout without an excessive temperature increase or loss of properties of the mixture.
3. Do not exceed 5 gal of water per 94 lb of cement or the quantity of water in the manufacturer's instructions, whichever is less.
4. Agitate the grout continuously until the grout is pumped. Do not add water after the initial mixing.

50-1.03B(2)(d)(iii) Placing

Pump grout into the duct within 30 minutes of the 1st addition of the mix components.

Inject grout from the lowest point of the duct in an uphill direction in 1 continuous operation maintaining a one-way flow of the grout. You may inject from the lowest anchorage if complete filling is ensured.

Before injecting grout, open all vents.

Continuously discharge grout from the vent to be closed. Do not close any vent until free water, visible slugs of grout, and entrapped air have been ejected and the consistency of the grout flowing from the vent is equivalent to the injected grout.

Pump the grout at a rate of 16 to 50 feet of duct per minute.

Conduct grouting at a pressure range of 10 to 50 psi measured at the grout inlet. Do not exceed maximum pumping pressure of 150 psi at the grout inlet.

As grout is injected, close the vents in sequence in the direction of flow starting with the closest vent.

Before closing the final vent at the grout cap, discharge at least 2 gal of grout into a clean receptacle.

Bleed all high point vents.

Lock a pressure of 5 psi into the duct by closing the grout inlet valve.

50-1.03B(2)(d)(iv) Weather Conditions

If hot weather conditions will contribute to quick stiffening of the grout, cool the grout by authorized methods as necessary to prevent blockages during pumping activities.

If freezing weather conditions are anticipated during and following the placement of grout, provide adequate means to protect the grout in the ducts from damage by freezing.

50-1.03B(2)(d)(v) Curing

During grouting and for a period of 24 hours after grouting, eliminate vibration from contractor controlled sources within 100 feet of the span in which grouting is taking place, including from moving vehicles, jackhammers, large compressors or generators, pile driving activities, soil compaction, and falsework removal. Do not vary loads on the span.

For PC concrete members, do not move or disturb the members after grouting for 24 hours. If ambient temperature drops below 50 degrees F, do not move or disturb the members for 48 hours.

Do not remove or open valves until grout has cured for at least 24 hours.

50-1.03B(2)(d)(vi) Grouting Equipment

Grouting equipment must be:

1. Capable of grouting at a pressure of at least 100 psi
2. Equipped with a pressure gage having a full-scale reading of not more than 300 psi
3. Able to continuously grout the longest tendon on the project in less than 20 minutes

Grout must pass through a screen with clear openings of 1/16 inch or less before entering the pump.

Fit grout injection pipes, ejection pipes, and vents with positive mechanical shutoff valves capable of withstanding the pumping pressures. Do not remove or open valves until the grout has set. If authorized, you may substitute mechanical valves with suitable alternatives after demonstrating their effectiveness.

Provide a standby grout mixer and pump.

50-1.03B(2)(d)(vii) Grout Storage

Store grout in a dry environment.

50-1.03B(2)(d)(viii) Blockages

If the grouting pressure reaches 150 psi, close the inlet and pump the grout at the next vent that has just been or is ready to be closed as long as a one-way flow is maintained. Do not pump grout into a succeeding outlet from which grout has not yet flowed.

When complete grouting of the tendon cannot be achieved by the steps specified, stop the grouting operation.

50-1.03B(2)(d)(ix) Secondary Grouting

Perform secondary grouting by vacuum grouting under the direct supervision of a person who has been trained and has experience in the use of vacuum grouting equipment and procedures.

The vacuum grouting process must be able to determine the size of the void and measure the volume of grout filling the void.

7. Pipe culvert headwalls, endwalls, and wingwalls for a pipe with a diameter of 5 feet or greater

Falsework must comply with section 48-2.

Joints must comply with section 51-2.

Elastomeric bearing pads must comply with section 51-3.

Reinforcement for the following concrete structures must comply with section 52:

1. Sound wall footings
2. Sound wall pile caps
3. Barrier slabs
4. Junction structures
5. Minor structures
6. PC concrete members

You may use RSC for a concrete structure only where the specifications allow the use of RSC.

Replace "sets" in the 1st paragraph of section 51-1.01C(2) with:

copies

07-19-13

Replace the heading of section 51-1.01D(4) with:

Testing Concrete Surfaces

04-19-13

Add to section 51-1.01D(4)(a):

The Engineer tests POC deck surfaces for smoothness and crack intensity.

04-19-13

Add to the list in the 1st paragraph of section 51-1.01D(4)(b):

3. Completed deck surfaces, including ramps and landings of POCs

04-19-13

Replace the 4th paragraph in section 51-1.01D(4)(b) with:

Except for POCs, surface smoothness is tested using a bridge profilograph under California Test 547. Two profiles are obtained in each lane approximately 3 feet from the lane lines and 1 profile is obtained in each shoulder approximately 3 feet from the curb or rail face. Profiles are taken parallel to the direction of traffic.

04-19-13

Add between the 5th and 6th paragraphs of section 51-1.01D(4)(b):

POC deck surfaces must comply with the following smoothness requirements:

04-19-13

1. Surfaces between grade changes must not vary more than 0.02 foot from the lower edge of a 12-foot-long straightedge placed parallel to the centerline of the POC
2. Surface must not vary more than 0.01 foot from the lower edge of a 6-foot-long straightedge placed perpendicular to the centerline of the POC

Add to section 51-1.01D(4)(d):

04-19-13

The Engineer measures crack intensity of POC deck surfaces after curing, before prestressing, and before falsework release. Clean the surface for the Engineer to measure surface crack intensity.

In any 100 sq ft portion of a new POC deck surface, if there are more than 10 feet of cracks having a width at any point of over 0.02 inch, treat the deck with methacrylate resin under section 15-5.05. Treat the entire deck width between the curbs to 5 feet beyond where the furthest continuous crack emanating from the 100 sq ft section is 0.02 inch wide. Treat the deck surface before grinding.

Replace the 2nd paragraph of section 51-1.02B with:

07-19-13

Except for minor structures, the minimum required 28-day compressive strength for concrete in structures or portions of structures is the compressive strength described or 3,600 psi, whichever is greater.

Add to section 51-1.03C(2)(c)(i):

04-20-12

Permanent steel deck forms are only allowed where shown or if specified as an option in the special provisions.

Replace the 3rd paragraph of section 51-1.03C(2)(c)(ii) with:

04-20-12

Compute the physical design properties under AISI's *North American Specification for the Design of Cold-Formed Steel Structural Members*.

Replace the 8th paragraph of section 51-1.03D(1) with:

10-19-12

Except for concrete placed as pipe culvert headwalls and endwalls, slope paving and aprons, and concrete placed under water, consolidate concrete using high-frequency internal vibrators within 15 minutes of placing concrete in the forms. Do not attach vibrators to or hold them against forms or reinforcing steel. Do not displace reinforcement, ducts, or prestressing steel during vibrating.

Add to section 51-1.03E(5):

08-05-11

Drill the holes without damaging the adjacent concrete. If reinforcement is encountered during drilling before the specified depth is attained, notify the Engineer. Unless coring through the reinforcement is authorized, drill a new hole adjacent to the rejected hole to the depth shown.

Add to section 51-1.03F(5)(a):

04-19-13

For approach slabs, sleeper slabs, and other roadway surfaces of concrete structures, texture the roadway surface as specified for bridge deck surfaces in section 51-1.03F(5)(b).

Replace "Reserved" in section 51-1.03F(5)(b) with:

04-20-12

51-1.03F(5)(b)(i) General

Except for bridge widenings, texture the bridge deck surfaces longitudinally by grinding and grooving or by longitudinal tining.

10-19-12

For bridge widenings, texture the deck surface longitudinally by longitudinal tining.

04-20-12

In freeze-thaw areas, do not texture PCC surfaces of bridge decks.

51-1.03F(5)(b)(ii) Grinding and Grooving

When texturing the deck surface by grinding and grooving, place a 1/4 inch of sacrificial concrete cover on the bridge deck above the finished grade shown. Place items to be embedded in the concrete based on the final profile grade elevations shown. Construct joint seals after completing the grinding and grooving.

Before grinding and grooving, deck surfaces must comply with the smoothness and deck crack treatment requirements.

Grind and groove the deck surface as follows:

1. Grind the surface to within 18 inches of the toe of the barrier under section 42-3. Grinding must not reduce the concrete cover on reinforcing steel to less than 1-3/4 inches.
2. Groove the ground surfaces longitudinally under section 42-2. The grooves must be parallel to the centerline.

51-1.03F(5)(b)(iii) Longitudinal Tining

When texturing the deck surface by longitudinal tining, perform initial texturing with a burlap drag or broom device that produces striations parallel to the centerline. Perform final texturing with spring steel tines that produce grooves parallel with the centerline.

The tines must:

1. Be rectangular in cross section
2. Be from 3/32 to 1/8 inch wide on 3/4-inch centers
3. Have enough length, thickness, and resilience to form grooves approximately 3/16 inch deep

Construct grooves to within 6 inches of the layout line of the concrete barrier toe. Grooves must be from 1/8 to 3/16 inch deep and 3/16 inch wide after concrete has hardened.

For irregular areas and areas inaccessible to the grooving machine, you may hand construct grooves. Hand-constructed grooves must comply with the specifications for machine-constructed grooves.

Tining must not cause tearing of the deck surface or visible separation of coarse aggregate at the surface.

Add to section 51-1.03F:

04-19-13

51-1.03F(6) Finishing Pedestrian Overcrossing Surfaces

Construct deck surfaces, including ramps and landings of POCs to the grade and cross section shown. Surfaces must comply with the specified smoothness, surface texture, and surface crack requirements.

The Engineer sets deck elevation control points for your use in establishing the grade and cross section of the deck surface. The grade established by the deck elevation control points includes all camber allowances. Except for landings, elevation control points include the beginning and end of the ramp and will not be closer together than approximately 8 feet longitudinally and 4 feet transversely to the POC centerline. Landing elevation control points are at the beginning and the end of the landing.

Broom finish the deck surfaces of POCs. Apply the broom finish perpendicular to the path of travel. You may apply water mist to the surface immediately before brooming.

Clean any discolored concrete by abrasive blast cleaning or other authorized methods.

Replace the paragraphs of section 51-1.04 with:

10-19-12

If concrete involved in bridge work is not designated by type and is not otherwise paid for under a separate bid item, the concrete is paid for as structural concrete, bridge.

The payment quantity for structural concrete includes the volume in the concrete occupied by bar reinforcing steel, structural steel, prestressing steel materials, and piling.

The payment quantity for seal course concrete is the actual volume of seal course concrete placed except the payment quantity must not exceed the volume of concrete contained between vertical planes 1 foot outside the neat lines of the seal course shown. The Department does not adjust the unit price for an increase or decrease in the seal course concrete quantity.

Structural concrete for pier columns is measured as follows:

1. Horizontal limits are vertical planes at the neat lines of the pier column shown.
2. Bottom limit is the bottom of the foundation excavation in the completed work.
3. Upper limit is the top of the pier column concrete shown.

The payment quantity for drill and bond dowel is determined from the number and depths of the holes shown.

Replace section 51-2.01B(2) with:

04-19-13

51-2.01B(2) Reserved

04-19-13

Delete the 4th paragraph of section 51-2.01C.

Replace "SSPC-QP 3" in the 1st paragraph of section 51-2.02A(2) with:

10-19-12

AISC-420-10/SSPC-QP 3

Replace the 2nd and 3rd paragraphs of section 51-2.02B(3)(b) with:

04-20-12

Concrete saws for cutting grooves in the concrete must have diamond blades with a minimum thickness of 3/16 inch. Cut both sides of the groove simultaneously for a minimum 1st pass depth of 2 inches. The completed groove must have:

1. Top width within 1/8 inch of the width shown or ordered
2. Bottom width not varying from the top width by more than 1/16 inch for each 2 inches of depth
3. Uniform width and depth

Cutting grooves in existing decks includes cutting any conflicting reinforcing steel.

Replace "sets" in the 1st and 2nd paragraphs of section 51-2.02D(1)(c)(ii) with:

copies

04-19-13

Replace "set" in the 7th paragraph of section 51-2.02D(1)(c)(ii) with:

copy

04-19-13

Add to the 1st paragraph of section 51-2.02D(3):

POC deck surfaces must comply with section 51-1.03F(6) before placing and anchoring joint seal assemblies.

04-19-13

Replace "sets" in the 2nd paragraph of section 51-2.02E(1)(c) with:

copies

04-19-13

Replace "set" in the 6th paragraph of section 51-2.02E(1)(c) with:

copy

04-19-13

Replace the 2nd paragraph of section 51-2.02E(1)(e) with:

Except for components in contact with the tires, the design loading must be the AASHTO LRFD Bridge Design Specifications Design Truck with 100 percent dynamic load allowance. Each component in contact with the tires must support a minimum of 80 percent of the AASHTO LRFD Bridge Design Specifications Design Truck with 100 percent dynamic load allowance. The tire contact area must be 10 inches measured normal to the longitudinal assembly axis by 20 inches wide. The assembly must provide a smooth-riding joint without slapping of components or tire rumble.

08-05-11

Replace "sets" in the 1st and 2nd paragraphs of section 51-2.02F(1)(c) with:

copies

04-19-13

Add between the 1st and 2nd paragraphs of section 51-4.01A:

Prestressing concrete members must comply with section 50.

10-19-12

Delete the 2nd paragraph of section 51-4.01A.

04-20-12

Replace the 3rd paragraph of section 51-4.01C(2) with:

For segmental or spliced-girder construction, shop drawings must include the following additional information:

04-20-12

1. Details showing construction joints or closure joints
2. Arrangement of bar reinforcing steel, prestressing tendons, and pressure-grouting pipe
3. Materials and methods for making closures
4. Construction joint keys and surface treatment
5. Other requested information

For segmental girder construction, shop drawings must include concrete form and casting details.

Replace "sets" in the 1st paragraph of section 51-4.01C(3) with:

copies

04-19-13

Delete the 1st and 2nd paragraphs of section 51-4.02A.

10-19-12

Replace the 3rd paragraph of section 51-4.02B(2) with:

04-20-12

For segmental or spliced-girder construction, materials for construction joints or closure joints at exterior girders must match the color and texture of the adjoining concrete.

Add to section 51-4.02B(2):

04-20-12

At spliced-girder closure joints:

1. If shear keys are not shown, the vertical surfaces of the girder segment ends must be given a coarse texture as specified for the top surface of PC members.
2. Post-tensioning ducts must extend out of the vertical surface of the girder segment closure end sufficiently to facilitate splicing of the duct.

For spliced girders, pretension strand extending from the closure end of the girder segment to be embedded in the closure joint must be free of mortar, oil, dirt, excessive mill scale and scabby rust, and other coatings that would destroy or reduce the bond.

Add to section 51-4.03B:

04-20-12

The specifications for prestressing force distribution and sequencing of stressing in the post-tensioning activity in 50-1.03B(2)(a) do not apply if post-tensioning of spliced girders before starting deck construction is described. The composite deck-girder structure must be post-tensioned in a subsequent stage.

Temporary spliced-girder supports must comply with the specifications for falsework in section 48-2.

Before post-tensioning of spliced girders, remove the forms at CIP concrete closures and intermediate diaphragms to allow inspection for concrete consolidation.

Add to section 51-5.01A:

07-19-13

Structure excavation and backfill must comply with section 19-3.

Treated permeable base must comply with section 29.

Delete the 1st paragraph of section 51-5.03B(3).

07-19-13

Delete the 2nd paragraph of section 51-5.03D(1).

07-19-13

Add between the 1st and 2nd paragraphs of section 51-7.01A:

Minor structures include:

10-19-12

1. Pipe culvert headwalls and endwalls for a pipe with a diameter less than 5 feet
2. Drainage inlets
3. Other structures described as minor structures

Delete the 4th paragraph of section 51-7.01A.

10-19-12

Replace the 1st and 2nd paragraphs of section 51-7.01B with:

Concrete must comply with the specifications for minor concrete.

10-19-12

Add to section 51:

51-8-51-15 RESERVED

10-19-12

AA

52 REINFORCEMENT

01-18-13

Add to section 52-1.01A:

Splicing of bar reinforcement must comply with section 52-6.

07-20-12

Replace the 1st and 2nd paragraphs of section 52-1.02B with:

Reinforcing bars must be deformed bars complying with ASTM A 706/A 706M, Grade 60, except you may use:

10-19-12

1. Deformed bars complying with ASTM A 615/A 615M, Grade 60, in:
 - 1.1. Junction structures
 - 1.2. Sign and signal foundations
 - 1.3. Minor structures
 - 1.4. Concrete crib members
 - 1.5. Mechanically-stabilized-embankment concrete panels
 - 1.6. Masonry block sound walls
2. Deformed or plain bars complying with ASTM A 615/A 615M, Grade 40 or 60, in:
 - 2.1. Slope and channel paving
 - 2.2. Concrete barriers Type 50 and 60
3. Plain bars for spiral or hoop reinforcement in structures and concrete piles

Add to the list in the 3rd paragraph of section 52-1.02B:

04-20-12

- 9. Shear reinforcement stirrups in PC girders

Replace the 6th paragraph of section 52-6.01D(4)(a) with:

01-18-13

Before performing service splice or ultimate butt splice testing, perform total slip testing on the service splice or ultimate butt splice test samples under section 52-6.01D(4)(b).

Replace section 52-6.02D with:

10-21-11

52-6.02D Ultimate Butt Splice Requirements

When tested under California Test 670, ultimate butt splice test samples must demonstrate necking as either of the following:

- 1. For "Necking (Option I)," the test sample must rupture in the reinforcing bar outside of the affected zone and show visible necking.
- 2. For "Necking (Option II)," the largest measured strain must be at least:
 - 2.1. Six percent for no. 11 and larger bars
 - 2.2. Nine percent for no. 10 and smaller bars

Replace the 2nd and 3rd paragraphs of section 52-6.03B with:

01-18-13

Do not splice the following by lapping:

- 1. No. 14 bars
- 2. No. 18 bars
- 3. Hoops
- 4. Reinforcing bars where you cannot provide a minimum clear distance of 2 inches between the splice and the nearest adjacent bar

AA

53 SHOTCRETE

07-19-13

Replace the 2nd and 3rd paragraphs of section 53-2.01D(1) with:

07-19-13

Obtain and test all cores for compressive strength under ASTM C 42/C 42M at an authorized laboratory. The compressive strength is the average strength of the 3 cores.

Shotcrete must have a minimum compressive strength of 3,600 psi, unless otherwise described. The shotcrete must attain the minimum compressive strength at 28 days, except 42 days are allowed for shotcrete with a described minimum compressive strength greater than 3,600 psi.

AA

12. Material specification and grade listed on the bill of materials.
13. Identification of tension members and fracture critical members.
14. Proposed deviations from plans, specifications, or previously submitted shop drawings.
15. Contract plan sheet references for details.

Replace items 2 and 3 in the list in the 1st paragraph of section 55-1.01C(3) with:

07-19-13

2. Tension flanges and webs of horizontally curved girders
3. Hanger plates

Replace the 2nd paragraph of section 55-1.01C(3) with:

07-19-13

Furnish plates, shapes, or bars with extra length to provide for removal of check samples.

Delete the 1st and 2nd sentences in the 3rd paragraph of section 55-1.01C(3).

07-19-13

Replace the 4th paragraph of section 55-1.01C(3) with:

07-19-13

Remove material for test samples in the Engineer's presence. Test samples for plates over 24 inches wide must be 10 by 12 inches with the long dimension transverse to the direction of rolling. Test samples for other products must be 12 inches long taken in the direction of rolling with a width equal to the product width.

Replace the 1st sentence of the 6th paragraph in section 55-1.01C(3) with:

07-19-13

Results of check testing are delivered to you within 20 days of receipt of samples at METS.

Delete the 2nd paragraph of section 55-1.01D(1).

07-19-13

Replace the 2nd sentence of the 4th paragraph in section 55-1.01D(1) with:

07-19-13

The calibration must be performed by an authorized repair and calibration center approved by the tool manufacturer.

Add to section 55-1.01D(1):

07-19-13

For bolts installed as snug tight, rotational capacity testing and installation tension testing are not required.

In addition to NDT requirements in AWS D1.5, ultrasonically test 25 percent of all main member tension butt welds in material over 1/2 inch thick.

Perform NDT on 100 percent of each pin as follows:

1. MT under ASTM A 788, S 18, with no linear indication allowed exceeding 3 mm
2. UT under ASTM A 788, S 20, level S and level DA in two perpendicular directions

The Engineer determines the location of all NDT testing for welding.

07-19-13

Delete the 2nd paragraph of section 55-1.01D(3)(a).

Replace section 55-1.01D(4)(b) with:

07-19-13

Perform rotational capacity testing on each rotational capacity lot under section 55-1.01D(3)(b) at the job site before installation.

Replace the 1st sentence of the 2nd paragraph in section 55-1.01D(4)(c) with:

07-19-13

Test 3 representative HS fastener assemblies under section 8 of *Specification for Structural Joints Using High-Strength Bolts* of the RCSC.

Replace the 1st paragraph in section 55-1.01D(4)(d) with:

07-19-13

Perform fastener tension testing to verify minimum tension in HS bolted connections no later than 48 hours after all fasteners in a connection have been tensioned.

Replace the 3rd paragraph in section 55-1.01D(4)(d) with:

07-19-13

Test 10 percent of each type of fastener assembly in each HS bolted connection for minimum tension using the procedure described in section 10 of *Specification for Structural Joints Using High-Strength Bolts* of the RCSC. Check at least 2 assemblies per connection. For short bolts, determine the inspection torque using steps 1 through 7 of "Arbitration of Disputes, Torque Method-Short Bolts" in *Structural Bolting Handbook* of the Steel Structures Technology Center.

Replace the 1st table in the 1st paragraph of section 55-1.02A(1) with:

07-19-13

Structural Steel	
Material	Specification
Carbon steel	ASTM A 709/A 709M, Grade 36 or {ASTM A36/A36M} ^a
HS low alloy columbium vanadium steel	ASTM A 709/A 709M, Grade 50 or {ASTM A 992/A 992M or ASTM A 572/A 572M, Grade 50} ^a
HS low alloy structural steel	ASTM A 709/A 709M, Grade 50W or Grade HPS 50W, or {ASTM A 588/A 588M} ^a
HS 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, Grade 100W, or Grade HPS 100W, or {ASTM A 514/A 514M} ^a

^aGrades you may substitute for the equivalent ASTM A 709 steel subject to the modifications and additions specified and to the requirements of ASTM A 709.

Replace the 2nd table in the 1st paragraph of section 55-1.02A(1) with:

07-19-13

Fasteners

Material	Specification
Steel fastener components for general applications:	
Bolts and studs	ASTM A 307
Anchor bolts	ASTM F 1554 ^a
HS bolts and studs	ASTM A 449, Type 1 ^a
HS threaded rods	ASTM A 449, Type 1 ^a
HS nonheaded anchor bolts	ASTM F 1554, Grade 105, Class 2A ^a
Nuts	ASTM A 563, including appendix X1 ^b
Washers	ASTM F 844
Hardened Washers	ASTM F 436, Type 1, including S1 supplementary requirements
Components of HS 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 ^b
Hardened washers	ASTM F 436, Type 1, Circular, including S1 supplementary requirements
Direct tension indicators	ASTM F 959, Type 325, zinc-coated

^aUse hardened washers.

^bZinc-coated nuts tightened beyond snug or wrench tight must be furnished with a dry lubricant complying with supplementary requirement S2 in ASTM A 563.

Replace the 3rd table in the 1st paragraph of section 55-1.02A(1) with:

07-19-13

Other Materials

Material	Specification
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 709/A 709M or ASTM A 563, including appendix X1 ^a
Carbon-steel castings	ASTM A 27/A 27M, Grade 65-35, Class 1
Malleable iron castings	ASTM A 47/A 47M, Grade 32510
Gray iron castings	ASTM A 48, Class 30B
Carbon steel structural tubing	ASTM A 500/A 500M, Grade B, ASTM A 501, ASTM A 847/A 847M, or ASTM A 1085
Steel pipe ^b	ASTM A 53, Type E or S, Grade B; ASTM A 106, Grade B; or ASTM A 139, Grade B
Stud connectors	ASTM A 108

^aZinc-coated nuts tightened beyond snug or wrench tight must be furnished with a dry lubricant complying with supplementary requirement S2 in ASTM A 563.

^bHydrostatic testing will not apply.

Replace the table in the 1st paragraph in section 55-1.02A(2) with:

07-19-13

Material complying with ASTM A 709/A 709M	CVN impact value (ft-lb at temperature)
Grade 36	15 at 40 °F
Grade 50 ^a (Thickness up to 2 inches)	15 at 40 °F
Grade 50W ^a (Thickness up to 2 inches)	15 at 40 °F
Grade 50 ^a (Thickness over 2 inches up to 4 inches)	20 at 40 °F
Grade 50W ^a (Thickness over 2 inches up to 4 inches)	20 at 40 °F
Grade HPS 50W ^a (Thickness up to 4 inches)	20 at 10 °F
Grade HPS 70W (Thickness up to 4 inches)	25 at -10 °F
Grade 100 (Thickness of 2-1/2 inches or less)	25 at 0 °F
Grade 100W (Thickness over 2-1/2 inches up to 4 inches)	35 at 0 °F
Grade HPS 100W (Thickness of 2-1/2 inches or less)	25 at -30 °F
Grade HPS 100W (Thickness over 2-1/2 inches up to 4 inches)	35 at -30 °F

^aIf the material yield strength is more than 65,000 psi, reduce the temperature for the CVN impact value 15 degrees F for each increment of 10,000 psi above 65,000 psi.

Replace the 1st sentence of the 1st paragraph in section 55-1.02A(5) with:

07-19-13

Steel, gray iron, and malleable iron castings must have continuous fillets cast in place in reentrant angles.

Delete the 3rd and 4th sentences in the 2nd paragraph in section 55-1.02A(5).

07-19-13

Replace the 1st paragraph of section 55-1.02B(1) with:

07-19-13

Section 55-1.02B(1) applies to work performed at the source and at the job site.

Replace the 4th paragraph in section 55-1.02B(1) with:

07-19-13

Ends of girder stiffeners shown as tight-fit must bear on the girder flange with at least point bearing. Local clearances between the end of the stiffener and the girder flange must be at most 1/16 inch.

Replace the 1st sentence of the 5th paragraph in section 55-1.02B(1) with:

07-19-13

Fabricate floor beams, stringers, and girders having end connection angles to exact length back to back of connection angles.

Add to the 7th paragraph in section 55-1.02B(1):

07-19-13

Use low-stress stamps for fracture critical members and tension members.

Replace the 2nd sentence of the 9th paragraph in section 55-1.02B(1) with:

07-19-13

Slightly round edges and sharp corners, including edges marred, cut, or roughened during handling or erection.

Replace the 3rd paragraph in section 55-1.02B(2) with:

07-19-13

Instead of machining, you may heat straighten steel not in contact with other metal bearing surfaces if the above tolerances are met.

Replace item 2 in the list in the 1st paragraph of section 55-1.02B(3) with:

07-19-13

2. Radius of bend measured to the concave face must comply with *Manual of Steel Construction* of the AISC

Replace the 1st sentence of the 2nd paragraph in section 55-1.02B(3) with:

07-19-13

Plates to be bent to a smaller radius than specified in *Manual of Steel Construction* of the AISC must be bent hot.

Replace the introductory clause of the 2nd paragraph of section 55-1.02B(4) with:

07-19-13

Threads for pin ends and pin nuts 1-1/2 inches or more in diameter must comply with the following:

Replace the 3rd paragraph in section 55-1.02B(5) with:

07-19-13

Holes for pins must be:

1. True to the diameter specified.
2. At right angles to the member axis.
3. Parallel with each other except for pins where nonparallel holes are required.
4. Smooth and straight with the final surface produced by a finishing cut.

Replace the 1st paragraph in section 55-1.02B(6)(c) with:

07-19-13

Bolted connections using HS fastener assemblies must comply with *Specification for Structural Joints Using High-Strength Bolts* of the RCSC.

Replace the 7th paragraph in section 55-1.02B(6)(c) with:

07-19-13

For all bolts, thread stickout after tensioning must be at least flush with the outer nut face. At least 3 full threads must be located within the grip of the connection.

Delete the 3rd paragraph in section 55-1.02B(7)(a).

Add to section 55-1.02B(7)(a):

07-19-13

For welds indicated to be subject to tensile forces that are to receive RT, grind smooth and flush on both sides of welds before testing.

For groove weld surface profiles that interfere with NDT procedures, grind welds smooth and blend with the adjacent material.

For fillet weld surface profiles that interfere with NDT procedures, grind welds and blend the toes smoothly with the adjacent base metal.

Add to section 55-1.02B(7):

07-19-13

55-1.02B(7)(c) Steel Pedestrian Bridges

Reserved

Replace the 1st paragraph in section 55-1.02B(9) with:

07-19-13

Prepare and paint contact surfaces of HS bolted connections before assembly. Thoroughly clean all other surfaces of metal in contact to bare metal before assembly. Remove all rust, mill scale, and foreign material.

Replace the 1st sentence of the 4th paragraph in section 55-1.02B(9) with:

07-19-13

Preassemble truss work in lengths of at least 3 abutting panels and adjust members for line and camber.

Replace the 1st sentence of the 5th paragraph in section 55-1.02B(9) with:

07-19-13

Preassemble bolted splice joints for plate girders in lengths of at least 3 abutting sections and adjust abutting sections for line and camber.

Replace the 6th paragraph in section 55-1.02B(9) with:

07-19-13

Preassemble prepared splice joints for welded girders with abutting members and adjust for line and camber.

Replace the paragraphs in section 55-1.03C(1) with:

07-19-13

Reserved

Replace the 3rd sentence of the 1st paragraph in section 55-1.03C(2) with:

07-19-13

Attain full bearing on the concrete under bearing assemblies.

59 PAINTING

11-15-13

Replace "SSPC-SP 10" at each occurrence in section 59 with:

SSPC-SP 10/NACE no. 2

10-19-12

Replace "SSPC-SP 6" at each occurrence in section 59 with:

SSPC-SP 6/NACE no. 3

10-19-12

Replace "SSPC-CS 23.00" at each occurrence in section 59 with:

SSPC-CS 23.00/AWS C 2.23M/NACE no. 12

10-19-12

Replace "*Specification for Structural Joints Using ASTM A325 or A 490 Bolts*" in the 1st paragraph of section 59-2.01C(1) with:

Specification for Structural Joints Using High-Strength Bolts

07-19-13

Replace "SSPC-QP 3 or AISC SPE, Certification P-1 Enclosed" in item 3 in the list in the 1st paragraph of section 59-2.01D(1) with:

AISC-420-10/SSPC-QP 3 (Enclosed Shop)

10-19-12

Replace "*Specification for Structural Joints Using ASTM A325 or A 490 Bolts*" in the 1st paragraph of section 59-2.02 with:

Specification for Structural Joints Using High-Strength Bolts

07-19-13

Replace the paragraphs in section 59-2.03A with:

Clean and paint all exposed structural steel and other metal surfaces.

10-19-12

You must provide enclosures for cleaning and painting structural steel. Cleaning and painting of new structural steel must be performed in an Enclosed Shop as defined in AISC-420-10/SSPC-QP 3. Maintain atmospheric conditions inside enclosures within specified limits.

Except for blast cleaning within closed buildings, perform blast cleaning and painting during daylight hours.

Add to section 59-2.03B:

07-19-13

59-2.03B(3) Containment Systems

59-2.03B(3)(a) General

Construct containment systems when disturbing existing paint systems during bridge rehabilitation.

The containment system must be one of the following:

1. Ventilated containment system
2. Vacuum-shrouded surface preparation equipment and drapes and ground covers
3. Equivalent containment system if authorized

The containment system must contain all water, resulting debris, and visible dust produced when the existing paint system is disturbed.

Properly maintain the containment system while work is in progress and do not change the containment system unless authorized.

Containment systems over railroad property must provide the minimum clearances as specified in section 5-1.20C for the passage of railroad traffic.

59-2.03B(3)(b) Ventilated Containment Systems

59-2.03B(3)(b)(i) General

If flexible framing is used, support and fasten it to (1) prevent the escape of abrasive and blast materials due to whipping from traffic or wind and (2) maintain clearances.

If the wind speed reaches 50 mph or greater, relieve the wind pressure on the containment system using an authorized method.

59-2.03B(3)(b)(ii) Design Criteria

Scaffolding or supports for the ventilated containment system must not extend below the vertical clearance level nor to the ground line at locations within the roadbed.

For truss-type bridges, all connections of the ventilated containment system to the existing structure must be made through the deck, girder, stringer, or floor beam system. No connections are allowed that will cause bending stresses in a truss member.

The ventilated containment system must comply with section 7-1.02K(6)(e).

The minimum total design load for the ventilated containment system must consist of the sum of the dead and live vertical loads.

Dead and live loads are as follows:

1. Dead load must consist of the actual load of the ventilated containment system
2. Live loads for bridges with only spot blast cleaning work must consist of:
 - 2.1. Uniform load of at least 25 psf applied over the supported area
 - 2.2. Moving concentrated load of 1000 lb to produce maximum stress in the main supporting elements of the ventilated containment system
3. Live loads for bridges with 100 percent blast cleaning to bare metal must consist of:
 - 3.1. Uniform load of at least 45 psf, which includes 20 psf of sand load, applied over the supported area
 - 3.2. Moving concentrated load of 1000 lb to produce maximum stress in the main supporting elements of the ventilated containment system

Assumed horizontal loads do not need to be included in the design of the ventilated containment system.

Maximum allowable stresses must comply with section 48-2.01D(3)(c).

59-2.03B(3)(b)(iii) Ventilation

The ventilation system in the ventilated containment system must be of the forced input airflow type with fans or blowers.

Negative air pressure must be employed within the ventilated containment system and will be verified by visual methods by observing the concave nature of the ventilated containment system while taking into account wind effects or by using smoke or other visible means to observe airflow. The input airflow must be properly balanced with the exhaust capacity throughout the range of operations.

The exhaust airflow of the ventilation system in the ventilated containment system must be forced into wet or dry dust collectors or bag houses.

Replace item 1 in the list in the 2nd paragraph of section 59-2.03C(1) with:

10-19-12

1. Apply a stripe coat of undercoat paint on all edges, corners, seams, crevices, interior angles, junctions of joining members, weld lines, and similar surface irregularities. The stripe coat must completely hide the surface being covered. If spot blast cleaning portions of the bridge, apply the stripe coat of undercoat paint before each undercoat and follow with the undercoat as soon as practical. If removing all existing paint from the bridge, apply the undercoat first as soon as practical and follow with the stripe coat of undercoat paint for each undercoat.

Replace the heading of section 59-2.03C(2) with:

04-19-13

Zinc Coating System

Add to section 59-2.03C(2)(a):

04-19-13

Coatings for new structural steel and connections between new and existing structural steel must comply with the requirements shown in the following table:

Zinc Coating System

Description	Coating	Dry film thickness (mils)
All new surfaces:		
Undercoat	Inorganic zinc primer, AASHTO M 300 Type I or II	4–8
Finish coat ^a	Exterior grade latex ^b , 2 coats	2 minimum each coat, 4–8 total
Total thickness, all coats		8–14
Connections to existing structural steel:^c		
Undercoat	Inorganic zinc primer, AASHTO M 300 Type I or II	4–8
Finish coat ^a	Exterior grade latex ^b , 2 coats	2 minimum each coat, 4–8 total
Total thickness, all coats		8–14

^aIf no finish coats are described, a final coat of inorganic zinc primer is required.

^bExterior grade latex must comply with section 91-2.02 unless otherwise specified.

^cIncludes the following locations:

1. New and existing contact surfaces
2. Existing member surfaces under new HS bolt heads, nuts, or washers
3. Bare surfaces of existing steel after trimming, cutting, drilling, or reaming
4. Areas within a 4-inch radius from the point of application of heat for welding or flame cutting

Replace "*Specification for Structural Joints Using ASTM A325 or A 490 Bolts*" in the 7th paragraph of section 59-2.03C(2)(b)(i) with:

07-19-13

Specification for Structural Joints Using High-Strength Bolts

Add to section 59-2.03C:

04-19-13

59-2.03C(3) Moisture-Cured Polyurethane Coating System

Reserved

59-2.03C(4) State Specification Paint Waterborne Coating System

59-2.03C(4)(a) General

The State Specification PWB coating system for existing structural steel must comply with the requirements shown in the following table:

State Specification PWB Coating System			
Surface	Description	State Specification PWB Coating	Dry film thickness (mils)
Surfaces cleaned to bare metal ^a :	1st undercoat	145	2-3
	2nd undercoat	146	2-3
	1st finish coat	171	1.5-3
	2nd finish coat	172	1.5-3
	Total thickness, all coats	--	7-12
Existing painted surfaces to be topcoated:	Undercoat	146	2-3
	1st finish coat	171	1.5-3
	2nd finish coat	172	1.5-3
	Total thickness, new coats	--	5-9

^aIncludes locations of spot blast cleaning

59-2.03C(4)(b) Finish Coats

11-15-13

Reserved

Add to section 59-5.01:

04-19-13

Where specified, prepare and paint sign structures under sections 59-2 and 59-3.

Instead of submitting proof of the certification complying with SSPC-QP 1, you may submit documentation with the painting quality work plan showing compliance with the requirements in section 3 of SSPC-QP 1.

Instead of submitting proof of the certification complying with SSPC-QP 2, you may submit documentation with the painting quality work plan showing compliance with the requirements in sections 4.2 through 4.4 of SSPC-QP 2, Category A.

Instead of submitting proof of the certification complying with AISC-420-10/SSPC-QP 3 (Enclosed Shop), you may submit documentation with the painting quality work plan showing compliance with the requirements in sections 5 through 18 of AISC-420-10/SSPC-QP3.

Replace the paragraphs of section 59-5.03 with:

04-19-13

59-5.03A General

You may prepare and paint sign structures before or after erection. After erection, repair damaged paint to the satisfaction of the Engineer.

The total dry film thickness of finish coats on contact surfaces of galvanized HS bolted connections (1) must be from 1 to 4 mils and (2) may be applied in 1 application.

59-5.03B Undercoating of Ungalvanized Surfaces

Blast-cleaned surfaces must receive a single undercoat consisting of an inorganic zinc coating as specified in AASHTO M 300, Type I or Type II, except:

1. The first 2 sentences of section 5.6 do not apply
2. Section 5.6.1 does not apply

If you propose to use a coating that is not on the Authorized Material List, submit the required documentation specified in section 5.6 of AASHTO M 300. Allow 30 days for the Engineer's review.

59-5.03C Testing of Inorganic Zinc Coating

Perform adhesion and hardness testing no sooner than 72 hours after application of the single undercoat of inorganic zinc coating.

59-5.03D Finish Coating

The exposed area of inorganic zinc coating must receive a minimum of 2 finish coats of exterior grade latex paint.

The 1st finish coat color must match no. 24558 of FED-STD-595. The 2nd finish coat color must match no. 24491 of FED-STD-595. The total dry film thickness of the applications of the 2nd finish coat must be not less than 2 mils.

Replace section 59-7 with:

07-19-13

59-7 STAINING CONCRETE AND SHOTCRETE

59-7.01 GENERAL

59-7.01A General

59-7.01A(1) Summary

Section 59-7.01 includes specifications for preparing and staining concrete and shotcrete surfaces using an acid stain.

59-7.01A(2) Definitions

Reserved

59-7.01A(3) Submittals

Submit stain manufacturer's product data and application instructions at least 7 days before starting staining activities.

59-7.01A(4) Quality Control and Assurance

Reserved

59-7.01B Materials

59-7.01B(1) General

Reserved

59-7.01B(2) Stain

Stain must:

1. Be a water-based solution of inorganic metallic salts
2. Contain dilute acid that penetrates and etches the concrete or shotcrete surface
3. Be a commercial quality product designed specifically for exterior applications
4. Produce abrasion-resistant color deposits

59-7.01B(3) Sealer

Reserved

59-7.01B(4) Joint Sealing Compound

Reserved

59-7.01C Construction

59-7.01C(1) General

Seal joints between concrete and shotcrete surfaces to be stained and adjacent metal with joint sealing compound before applying the stain.

Test surfaces for acceptance of the stain before applying the stain. Clean surfaces that resist accepting the stain and retest until passing.

Apply the stain under the manufacturer's instructions.

Before staining, the concrete or shotcrete surfaces must be:

1. At least 28 days old
2. Prepared under SSPC-SP 13/NACE no. 6
3. Thoroughly dry

Apply the stain uniformly to avoid excessive rundown. Work the stain into the concrete using a nylon bristle brush in a circular motion.

After the last coat of stain has dried, rinse stained surfaces with water and wet scrub with a stiff bristle nylon brush until the rinse water runs clear. Collect all rinse water.

Protect adjacent surfaces during staining.

Thoroughly cure each application of the stain and correct skips, holidays, thin areas, or other deficiencies before the next application.

Drips, puddles, or other irregularities must be worked into the concrete or shotcrete surface.

59-7.01C(2) Test Panel

For staining concrete or shotcrete, stain a test panel complying with section 51-1.01D(3).

For staining sculpted shotcrete, stain a test panel complying with section 53-3.01D(3).

The test panel must be:

1. Stained using the same personnel, materials, equipment and methods to be used in the work
2. Accessible for viewing
3. Displayed in an upright position near the work
4. Authorized for staining before starting the staining work

If ordered, construct additional test panels until a satisfactory color is attained.

The Engineer uses the authorized stained test panel to determine the acceptability of the stained surface.

Dispose of the test panels after the staining work is complete and authorized. Notify the Engineer before disposing of the test panels.

59-7.01D Payment

Not Used

59-7.02 SCULPTED SHOTCRETE AND TEXTURED CONCRETE

59-7.02A General

59-7.02A(1) Summary

Section 59-7.02 includes specifications for preparing and staining sculpted shotcrete and textured concrete surfaces using an acid stain.

59-7.02A(2) Definitions

Reserved

59-7.02A(3) Submittals

59-7.02A(3)(a) General

Reserved

59-7.02A(3)(b) Experience Qualifications

Submit the following documentation of the staining subcontractor's experience at least 10 days before the preconstruction meeting:

1. Summary of the staining subcontractor's experience that demonstrates compliance with section 59-7.02A(4)(b).
2. List of at least 3 projects completed in the last 5 years that demonstrate the staining subcontractor's ability to stain textured concrete or sculpted shotcrete surfaces similar to the textured concrete or sculpted shotcrete for this project. For each project include:
 - 2.1. Project description
 - 2.2. Name and phone number of the owner
 - 2.3. Staining completion date
 - 2.4. Color photos of the completed stained surface

59-7.02A(3)(c) Installation Plan

Submit an installation plan at least 10 days before the preconstruction meeting. The installation plan must include details for preparing and staining the textured concrete or sculpted shotcrete to achieve the required color, including:

1. Number of applications that will be used to apply the stain
2. For each application of the stain, a description of:
 - 2.1. Manufacturer, color, finish, and percentage strength mixture of the stain that will be applied
 - 2.2. Methods and tools that will be used to apply the stain
3. Methods for protecting adjacent surfaces during staining
4. Rinse water collection plan for containing all liquid, effluent, and residue resulting from preparing and staining textured concrete or sculpted shotcrete

59-7.02A(4) Quality Control and Assurance

59-7.02A(4)(a) General

Reserved

59-7.02A(4)(b) Contractor Qualifications

The staining subcontractor must:

1. Have experience in staining textured concrete or sculpted shotcrete surfaces to simulate the appearance of natural rock formations or stone masonry
2. Have successfully completed at least 3 projects in the past 5 years involving staining of concrete or sculpted shotcrete surfaces similar to the textured concrete or sculpted shotcrete for this project

59-7.02A(4)(c) Preconstruction Meeting

Before starting staining activities, conduct a meeting to discuss the installation plan. Meeting attendees must include the Engineer and all staining subcontractors.

59-7.02B Materials

Not Used

59-7.02C Construction

Not Used

59-7.02D Payment

Prepare and stain concrete and prepare and stain shotcrete are measured by the area of the vertical or sloped wall face stained.

Replace "solider" in the 5th paragraph of section 59-9.03 with:

04-19-13

soldier

Replace section 59-11 with:

07-19-13

59-11 STAINING GALVANIZED SURFACES

Reserved

Replace section 59-12 with:

07-19-13

59-12 ROCK STAINING

59-12.01 GENERAL

59-12.01A Summary

Section 59-12 includes specifications for applying stain to the exterior surface of landscape boulders, native rock that has been damaged or scarred, rock energy dissipaters, rock slope protection and gabion surfaces.

59-12.01B Submittals

Submit the following:

1. Work plan showing methods to control overspray and spillage, and to protect adjacent surfaces
2. Product data including the manufacturer's product sheet and the instructions for the application of the stain

59-12.01C Quality Control and Assurance

59-12.01C(1) General

Reserved

59-12.01C(2) Test Plot

Apply the stain to a test plot rock area of at least 3 by 3 feet at a location designated by the Engineer. Notify the Engineer at least 7 days before staining the test plot. Prepare and stain the test plot with the same materials, tools, equipment, and methods to be used in staining the final surfaces. Separate test plots are required for staining rock slope protection and native rock.

If ordered, prepare additional test plots. Additional test plots are change order work.

Obtain authorization of the test plot before starting the staining work. Use the authorized test plot as the standard for comparison in determining acceptability of staining. If the test plot is not incorporated into the work and the Engineer determines it is no longer needed, dispose of it.

59-12.02 MATERIALS

59-12.02A General

Reserved

59-12.02B Stain

Reserved

59-12.03 CONSTRUCTION

59-12.03A General

Reserved

59-12.03B Preparation

Before applying the stain:

AA

65 CONCRETE PIPE

07-19-13

Replace the 2nd paragraph of section 65-1.01 with:

10-19-12

Concrete pipe includes all necessary elbows, wyes, tees, other branches, concrete collars or tees, and reinforcement.

Replace section 65-2.02D with:

07-19-13

65-2.02D Reserved

AA

70 MISCELLANEOUS DRAINAGE FACILITIES

07-19-13

Replace section 70-5.02A(2) with:

01-20-12

70-5.02A(2) Plastic Flared End Sections

Plastic flared end sections must comply with ASTM D 3350.

Replace "40-1.03N" in item 2.4 of the 1st paragraph of section 70-5.06C with:

07-19-13

40-1.03K

Replace the 2nd, 3rd, and 4th paragraphs of section 70-7.02B with:

01-18-13

Before shipping, the exterior surfaces of the casing must be cleaned, primed, and coated to comply with ANSI/AWWA C213 or ANSI/AWWA C214.

Wrapping tape for repairing damaged coating and wrapping field joints and fittings must be a pressure-sensitive PVC or polyethylene tape with a minimum thickness of 50 mils, 2 inches wide.

Add to section 70-7.03:

01-18-13

Repair damaged coating on the casing and wrap field joints and fittings with wrapping tape as follows:

1. Before wrapping, thoroughly clean and prime the pipe casing, joints, and fittings under the tape manufacturer's instructions.
2. Wrap the tape tightly with 1/2 uniform lap, free from wrinkles and voids to provide not less than a 100-mil thickness.
3. Wrapping at joints must extend at least 6 inches over adjacent pipe casing coverings. Apply tension such that the tape will conform closely to contours of the joint.

AA

74 PUMPING EQUIPMENT AND CONTROLS

04-19-13

Replace the 1st paragraph of section 74-1.01C(3) with:

04-19-13

Submit at least 5 copies of product data to OSD, Documents Unit. Each copy must be bound together and include an index stating equipment names, manufacturers, and model numbers. Two copies will be returned. Notify the Engineer of the submittal. Include in the notification the date and contents of the submittal.

Replace the 1st sentence of the 1st paragraph in section 74-2.01D(2) with:

01-20-12

Drainage pumps must be factory certified under ANSI/HI 14.6.

AA

75 MISCELLANEOUS METAL

07-19-13

Add between 2nd and 3rd paragraphs of section 75-1.03A:

07-19-13

Fabricate expansion joint armor from steel plates, angles, or other structural shapes. Shape the armor to the section of the concrete deck and match-mark it in the shop. Straighten warped sections of expansion joint armor before placing. Secure the expansion joint armor in the correct position during concrete placement.

Replace "SSPC-QP 3" in the 3rd paragraph of section 75-1.03E(4) with:

10-19-12

AISC-420-10/SSPC-QP3

Replace "metal beam guard railing" in the table in the 1st paragraph of section 75-1.05 with:

07-19-13

guardrail

AA

Replace section 78 with:

07-20-12

78 INCIDENTAL CONSTRUCTION

07-20-12

78-1 GENERAL

Section 78 includes specifications for incidental bid items that are not closely associated with other sections.

78-2-78-50 RESERVED

AA

80 FENCES

10-19-12

Add to section 80-2.02D:

10-19-12

Vertical stays must:

- 1. Comply with ASTM A641
- 2. Be 12-1/2 gage
- 3. Have a Class 3 zinc coating

Replace item 1 in the list in section 80-2.02E with:

10-19-12

Comply with ASTM A 116, Type Z, Grade 60, Class 1

Add after "galvanized wire" in the 1st paragraph of section 80-2.02F:

10-19-12

complying with ASTM A 641

Replace the 3rd and 4th paragraphs of section 80-2.02F with:

10-19-12

Each staple used to fasten barbed wire and wire mesh fabric to wood posts must:

- 1. Comply with ASTM F 1667
- 2. Be at least 1-3/4 inches long
- 3. Be manufactured from 9-gage galvanized wire

Wire ties used to fasten barbed wire and wire mesh to metal posts must be at least 11-gage galvanized wire complying with ASTM F 626. Clips and hog rings used for metal posts must be at least 9-gage galvanized wire complying with ASTM F 626.

Replace the 8th through 14th paragraphs of section 80-2.03 with:

10-19-12

Attach the wire mesh and barbed wire to each post.

Securely fasten tension wires to wood posts. Make a single or double loop around each post at each attachment point and staple the wire to the post. Use wire ties, hog rings, or wire clips to fasten the wires to the metal posts.

Connect each wood brace to its adjacent post with a 3/8 by 4-inch steel dowel. Twist the tension wires until the installation is rigid.

Stretch barbed wire and wire mesh fabric and fasten to each wood or steel end, corner, or gate post. Apply tension according to the manufacturer's instructions using a mechanical stretcher or other device designed for such use. If no tension is specified by the manufacturer, use 250 pounds for the required tension. Evenly distribute the pull over the longitudinal wires in the wire mesh such that no more than 50 percent of the original depth of the tension curves is removed. Do not use a motorized vehicle, truck, or tractor to stretch the wire.

Attach barbed wire and wire mesh fabric to the private-property side of posts. On curved alignments, place the wire mesh and barbed wire on the face of the post against which the normal pull of the wire

84 TRAFFIC STRIPES AND PAVEMENT MARKINGS

01-20-12

Replace the 1st paragraph in section 84-2.04 with:

01-20-12

A double extruded thermoplastic traffic stripe consisting of two 4-inch wide yellow stripes is measured as 2 traffic stripes.

A double sprayable thermoplastic traffic stripe consisting of two 4-inch wide yellow stripes is measured as 1 traffic stripe.

Add to section 84:

01-20-12

84-6 THERMOPLASTIC TRAFFIC STRIPES AND PAVEMENT MARKINGS WITH ENHANCED WET NIGHT VISIBILITY

Reserved

84-7-84-10 RESERVED

AA

86 ELECTRICAL SYSTEMS

11-15-13

Replace the paragraphs in section 86-1.01 with:

07-19-13

Section 86 includes general specifications for constructing and rehabilitating electrical systems.

Electrical systems must comply with the material and installation specifications in section 86-2.

Section 86-3 includes specifications for constructing controller assemblies.

Section 86-4 includes specifications for constructing traffic signal faces, programmed visibility signal faces, pedestrian signal faces, flashing beacons, ramp metering signs, and signal mounting assemblies.

Section 86-5 includes specifications for constructing vehicle detectors and pedestrian push button assemblies.

Section 86-6 includes specifications for constructing lighting systems.

Section 86-7 includes specifications for constructing rehabilitating electrical equipment.

Comply with Part 4 of the *California MUTCD*. Nothing in section 86 is to be construed as to reduce the minimum standards in this manual.

The locations shown for electrical systems are approximate; the Engineer determines the final locations.

Replace the paragraphs in section 86-1.015 with:

07-19-13

actuation: Actuation as defined in the *California MUTCD*.

channel: Discrete information path.

controller assembly: Assembly for controlling a system's operations, consisting of a controller unit and auxiliary equipment housed in a rainproof cabinet.

controller unit: Part of the controller assembly performing the basic timing and logic functions.

detector: Detector as defined in the *California MUTCD*.

electrolier: Assembly of a lighting standard and luminaire.

flasher: Device for opening and closing signal circuits at a repetitive rate.

flashing beacon control assembly: Assembly of switches, circuit breakers, terminal blocks, flasher, wiring, and other necessary electrical components housed in a single enclosure for operating a beacon.

inductive loop detector: Detector capable of being actuated by an inductance change caused by a 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 an induced voltage caused by a vehicle passing through the earth's magnetic field.

powder coating: Coating applied electrostatically using exterior-grade UV-stable polymer powder.

pretimed controller assembly: Assembly operating traffic signals under a predetermined cycle length.

pull box: A box with a cover that is installed in an accessible place in a run of conduit to facilitate the pulling in of wires or cables.

signal face: Signal face as defined in the *California MUTCD*.

signal head: Signal head as defined in the *California MUTCD*.

signal indication: Signal indication as defined in the *California MUTCD*.

signal section: Signal section as defined in the *California MUTCD*.

signal standard: Pole and mast arm supporting 1 or more signal faces with or without a luminaire mast arm.

traffic-actuated controller assembly: Assembly for operating traffic signals under the varying demands of traffic as registered by detector actuation.

traffic phase: Signal phase as defined in the *California MUTCD*.

vehicle: Vehicle as defined in the *California Vehicle Code*.

Replace the paragraphs in section 86-1.02 with:

07-19-13

Comply with 8 CA Code of Regs § 2299 et seq.

Electrical equipment must comply with one or more of the following standards:

1. ANSI
2. ASTM
3. EIA
4. NEMA
5. NETA
6. UL
7. Public Utilities Commission, General Order No. 95, "Rules for Overhead Electrical Sign Construction"
8. Public Utilities Commission, General Order No. 128, "Rules for Construction of Underground Electric Supply and Communication Systems"

Materials and workmanship must comply with:

1. FCC rules

2. ITE standards
3. NEC
4. California Electrical Code

Electrical equipment and materials must be NRTL certified wherever applicable.

Replace the paragraphs in section 86-1.03 with:

07-19-13

Submit a schedule of values within 15 days after Contract approval.

Determine the quantities required to complete the work. Submit the quantities as part of the schedule of values.

Provide a schedule of values for each lump sum bid item.

Do not include costs for the traffic control system in the schedule of values.

The schedule of values must include the 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 cabinets
8. Vehicle signal heads and hardware
9. Pedestrian signal heads and hardware
10. Push buttons
11. Loop detectors
12. Luminaires and lighting fixtures
13. Materials shown in the quantity tables on plan sheets labeled *E*

Replace the paragraphs in section 86-1.04 with:

07-19-13

Within 15 days of Contract approval, submit a list of equipment and materials that you propose to install. Submit the list before shipping equipment or materials to the job site. The list must include the following information:

1. Manufacturer's name
2. Make and model number
3. Month and year of manufacture
4. Lot and serial numbers
5. Dimensions
6. List of components
7. Manufacturer's installation instructions
8. Contract number
9. Your contact information

Supplement the list with 2 copies of the following data:

1. Schematic wiring diagrams
2. Scale drawings of cabinets showing location and spacing of shelves, terminal blocks, and equipment, including dimensions
3. Operation manual

Electrical equipment constructed as shown does not require detailed drawings and diagrams.

Submit 3 sets of computer-generated schematic wiring diagrams for the cabinet.

Place the schematic wiring diagram in a heavy-duty plastic envelope and attach it to the inside of the cabinet door.

Prepare diagrams, plans, and drawings using graphic symbols in IEEE 315, "Graphic Symbols for Electrical and Electronic Diagrams."

Replace the 5th paragraph of section 86-2.04B(2) with:

07-19-13

HS bolts, nuts, and flat washers used to connect slip base plates must comply with the requirements for HS fastener assemblies for use in structural steel joints in section 55-1.02A(1) except rotational capacity testing and tension testing are not required.

07-19-13

Delete the row for standard Type 36-20A in the table in the 6th paragraph of section 86-2.04B(2).

Replace the 10th paragraph of section 86-2.04B(2) with:

07-19-13

Bolted connections attaching signal or luminaire arm to the pole must be considered slip critical. Galvanized faying surfaces of plates on luminaire arm, 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 High-Strength Bolts* of the RCSC. Coatings for faying surfaces must comply with the RCSC specification for Class B coatings.

Replace the 1st sentence of item 8 in the list in the 1st paragraph of section 86-2.04B(3) with:

07-19-13

During manufacturing, longitudinal seams on vertical tubular members of cantilevered support structures must be within 90 degrees circumferentially of the center of the longest mast arm connection.

07-19-13

Delete item 15.3 in the list in the 1st paragraph of section 86-2.04B(3).

Add between "Exposed" and "conduit" in the 2nd paragraph of section 86-2.05B:

07-19-13

Type 1

Replace the 1st sentence of the 10th paragraph of section 86-2.05C with:

07-19-13

After installing conduit, install the pull tape.

Replace the 1st sentence of the 15th paragraph of section 86-2.05C with:

11-15-13

Conduit runs shown to be located behind curbs may be installed in the street within 3 feet of and parallel to the face of the curb by the trenching in pavement method.

Replace the 1st and 2nd sentences of the 2nd paragraph of section 86-2.05D with:

07-19-13

Install an expansion-deflection fitting for expansion joints with a 1-1/2-inch movement rating. The fitting must be watertight and include a molded neoprene sleeve, a bonding jumper, and 2 silicon bronze or zinc-plated iron hubs.

Replace section 86-2.06 with:

07-19-13

86-2.06 PULL BOXES

86-2.06A General

86-2.06A(1) Cover Marking

The cover marking must be clearly defined, uniform in depth, and parallel to either the long or short sides of the cover.

Marking letters must be 1 to 3 inches 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 such that the letters are raised a minimum of 3/32 inch.

86-2.06A(2) Installation and Use

Space pull boxes no more than 200 feet apart. You may install additional pull boxes to facilitate the work.

You may use a larger standard size pull box than that shown on the plans or specified.

A pull box in ground or sidewalk area must be installed as follows:

1. Embed bottom of the pull box in crushed rock.
2. Place a layer of roofing paper on the crushed rock.
3. Place grout over the layer of roofing paper. Grout must be 0.50 to 1 inch thick and sloped toward the drain hole.
4. Make a 1-inch drain hole in the center of the pull box through the grout and roofing paper.
5. Place grout between the pull box and the pull box extension, and around conduits.

The top of the pull box must be flush with the surrounding grade or the top of an adjacent curb, except in unpaved areas where the pull box is not immediately adjacent to and protected by a concrete foundation, pole, or other protective construction. Place the pull box 1-1/4 inches above the surrounding grade. Where practical, place a pull box shown in the vicinity of curbs or adjacent to a standard on the side of the foundation facing away from traffic. If a pull box is installed in a sidewalk area, adjust the depth of the pull box so that the top of the pull box is flush with the sidewalk.

Reconstruct the sump of an existing pull box if disturbed by your activities. Remove old grout and replace with new if the sump was grouted.

86-2.06B Non-Traffic Pull Boxes

Reserved

86-2.06C Traffic Pull Boxes

The traffic pull box and cover must comply with ASTM C857, "Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures," for HS20 loading. You must be able to place the load anywhere on the box and cover for 1 minute without causing cracks or permanent deformations.

Frame must be anchored to the box with 1/4 by 2-1/4 inch 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.

Nuts must be zinc-plated carbon steel, vibration resistant, and have a wedge ramp at the root of the thread.

After installation of traffic pull box, install the steel cover and keep it bolted down when your activities are not in progress at the pull box. When the steel cover is placed for the final time, the cover and Z bar frame must be cleaned of debris and tightened securely.

Steel cover must be countersunk approximately 1/4 inch to accommodate the bolt head. When tightened, the bolt head must not exceed more than 1/8 inch above the top of the cover.

Concrete placed around and under traffic pull boxes must be minor concrete.

Replace the 11th row in the table in the 1st paragraph of section 86-2.08B with:

07-19-13

Grounded circuit conductor	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
	Service	Wht	None	NBR	14

Replace the 1st sentence of the 1st paragraph of section 86-2.08C with:

07-19-13

Circuit conductors, connectors, and terminals must be UL or NRTL listed and rated for 600 V(ac) operation.

Add to the beginning of section 86-2.09A:

07-19-13

Provide enough traffic signal light conductors for functional operation of the signal. Provide 3 spare conductors in all conduits containing traffic signal light conductors.

Replace the paragraphs in section 86-2.09C with:

07-19-13

Connectors must be crimp type. Use a manufacturer-recommended tool for connectors and terminals to join conductors. Comply with SAE-AS7928.

Terminate stranded conductors smaller than no. 14 in crimp style terminal lugs.

Terminate field conductors no. 12 and smaller with spade type terminals. Terminate field conductors no. 10 and larger with spade type or ring type terminals.

Replace the value for resistivity in the table in the 6th paragraph of section 86-2.09E with:

07-19-13

$25 \times 10^{13} \Omega$ per inch, minimum

Add between "the" and "head" in the 3rd sentence of the 2nd paragraph of 86-2.09F:

connector

07-19-13

Replace "project" in the 3rd paragraph of section 86-2.11A with:

work

10-19-12

Replace "Contract" in item 2 in the list in the 11th paragraph of section 86-2.11A with:

work

10-19-12

Delete the 12th paragraph of section 86-2.11A.

07-19-13

Replace section 86-2.11C with:

86-2.11C Electrical Service for Booster Pumps

Provide electrical service from the service point to the booster pump.

Furnish conductors, conduit, and pull boxes from the service point to the booster pump.

Do not use Type 3 conduit unless shown otherwise.

07-19-13

Replace section 86-2.14A with:

86-2.14A General

Deliver material and equipment for acceptance testing to either METS or a testing location as ordered.

Allow 30 days for testing. The Department notifies you when testing is complete. You must pick up the material or equipment from the test site and deliver it to the job site.

If material or equipment is rejected, allow 30 days for retesting. The retesting period starts when replacement material or equipment is delivered to the test site.

If material or equipment submitted for testing does not comply with the specifications, remove it within 5 business days after you are notified that the equipment is rejected. If equipment is not removed within that period, the Department may ship it to you and deduct the shipping cost.

Testing and quality control procedures for traffic signal controller assemblies must comply with NEMA TS standards for traffic control systems.

07-19-13

Replace the 2nd paragraph of section 86-3.02A(1) with:

The Department furnishes the BBS components under section 6-2.03.

07-19-13

Replace the 9th paragraph of section 86-3.02B with:

07-19-13

The couplings between the external cabinet and Model 332L cabinet must include a conduit for power connections between the 2 cabinets. Couplings must include:

1. 2-inch nylon-insulated steel chase nipple
2. 2-inch sealing steel locknut
3. 2-inch nylon-insulated steel bushing

Delete item 1.3 in the list in the 7th paragraph of section 86-3.04A.

07-19-13

Replace the 2nd paragraph of section 86-4.01A with:

07-19-13

The housing must not fail structurally as described in the following table:

Housing Structural Failure

Housing type	Test method	Description of structural failure
Metal	California Test 666	Fracture within the housing assembly or deflection of more than half the lens diameter of the signal section during the wind load test
Plastic	California Test 605	Fracture within the housing assembly or deflection of more than 10 degrees in either the vertical or horizontal plane after the wind load has been removed from the front of the signal face or deflection of more than 6 degrees in either the vertical or horizontal plane after the wind load has been removed from the back of the signal face

Replace the 1st sentence of section 86-4.01A(1) with:

07-19-13

Each metal housing must have a metal visor.

Replace the 1st sentence of section 86-4.01A(2) with:

07-19-13

Each plastic housing must be molded in 1 piece or fabricated from 2 or more pieces and joined into a single piece.

Delete item 1 in the list in section 86-4.01D(1)(b).

07-19-13

Replace the paragraphs in section 86-4.01D(1)(c)(i) with:

07-19-13

LED signal modules must be on the Authorized Material List for LED traffic signals.

The Department tests modules under section 86-2.14A, ANSI/ASQ Z1.4, and:

1. California Test 604 for LED and circular LED signal modules
2. California Test 3001 for arrow, U-turn, and bicycle LED signal modules

The LED signal modules submitted for testing must be typical production units. LEDs must be spread evenly across the module.

The Department may test the modules on all parameters specified in section 86-4.01D.

Replace the 1st and 2nd sentences of the 3rd paragraph of 86-4.01D(2)(b) with:

The electrical connection for each flashing LED signal module must be 4 secured, color-coded, jacketed copper wires. The wire must comply with the NEC. 07-19-13

Replace the heading of section 86-4.02 with:

PROGRAMMED VISIBILITY VEHICLE SIGNAL SECTION

07-19-13

Replace "face" in the 1st paragraph of section 86-4.02 with:

section

07-19-13

Add before the 1st sentence in section 86-4.03A:

The pedestrian signal face must be Type A.

07-19-13

Replace the 1st sentence of the 2nd paragraph of section 86-4.03B with:

The Department tests the pedestrian signal's front screen in a horizontal position with its edges supported.

07-19-13

Delete items 1 and 4 in the list in section 86-4.03I(1)(b).

07-19-13

Replace the paragraphs of section 86-4.03I(1)(c)(i) with:

The LED PSF module must be on the Authorized Material List for LED traffic signals.

The Department tests LED PSF modules under section 86-2.14A, ANSI/ASQ Z1.4, and California Test 606.

The LED PSF modules submitted for testing must be representative of typical production units.

The Department may test the modules on all parameters specified in section 86-4.03I.

07-19-13

Replace item 1 in the list in the 1st paragraph of section 86-4.03I(2) with:

1. Not include reflectors.

07-19-13

Replace item 6 in the list in the 1st paragraph of section 86-4.03I(2) with:

07-19-13

6. Be able to replace signal lamp optical units and pedestrian signal faces with LEDs.

Replace the table titled "Chromaticity Standards (CIE Chart)" in the 16th paragraph of section 86-4.03I(2) with:

07-19-13

Chromaticity Standards (CIE Chart)

Upraised hand	X: not greater than 0.659 or less than 0.600 Y: not greater than 0.390 or less than 0.331 Y= 0.990-X
Walking person	X: not greater than 0.440 or less than 0.280 Y: not greater than 0.0483 + 0.7917(X) or less than 0.0983 + 0.7917(X)

Add between "beacon" and "must" in the 1st sentence of section 86-4.05:

07-19-13

signal face

Delete "face" in item 1 in the list in the 1st paragraph of section 86-4.05.

07-19-13

Replace the row for viscosity in the table in the 2nd paragraph of section 86-5.01A(3)(c) with:

07-19-13

Viscosity, Brookfield Thermosel, no. 27 Spindle, 20 rpm, 190 °C	D 4402	2.5–3.5 Pa·s
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Replace the paragraph in section 86-5.01A(3)(d) with:

07-19-13

Use epoxy sealant for repair work in and around sawcuts housing inductive loops.

Replace "all loop conductors" in the 3rd paragraph of section 86-5.01A(4) with:

07-19-13

the detector lead-in cable

Replace "Encase the loop wires" in the 1st sentence of the 3rd paragraph of section 86-5.01A(5) with:

07-19-13

The loop wires must be encased

Replace the row for hydraulic bursting strength in the table in the 2nd paragraph of section 88-1.02B with:

10-19-12

Puncture strength, lb min	ASTM D 6241	310
Trapezoid tearing strength, lb min	ASTM D 4533	56

Replace the 3rd paragraph in section 88-1.02C with:

10-19-12

Geocomposite wall drain must be from 0.25 to 2 inches thick.

Replace the value for permittivity of woven fabric in the table in the 1st paragraph of section 88-1.02E with:

01-20-12

0.05

Replace the value for apparent size opening of nonwoven fabric in the table in the 1st paragraph of section 88-1.02E with:

01-20-12

0.012

Replace the table in the 1st paragraph of section 88-1.02G with:

01-20-12

Sediment Filter Bag

Property	Test	Values	
		Woven	Nonwoven
Grab breaking load, lb, 1-inch grip min, in each direction	ASTM D 4632	200	250
Apparent elongation, percent min, in each direction	ASTM D 4632	10	50
Water flow rate, gal per minute/sq ft min and max average roll value	ASTM D 4491	100-200	75-200
Permittivity, sec ⁻¹ min	ASTM D 4491	1.0	1.0
Apparent opening size, inches max average roll value	ASTM D 4751	0.023	0.012
Ultraviolet resistance, % min retained grab breaking load, 500 hr.	ASTM D 4355	70	70

Replace the table in the 1st paragraph of section 88-1.02H with:

01-20-12

Temporary Cover

Property	Test	Values	
		Woven	Nonwoven
Grab breaking load, lb, 1-inch grip min, in each direction	ASTM D 4632	200	200
Apparent elongation, percent min, in each direction	ASTM D 4632	15	50
Water flow rate, gal per minute/sq ft min and max average roll value	ASTM D 4491	4-10	80-120
Permittivity, sec ⁻¹ min	ASTM D 4491	0.05	1.0
Apparent opening size, inches max average roll value	ASTM D 4751	0.023	0.012
Ultraviolet resistance, % min retained grab breaking load, 500 hr.	ASTM D 4355	70	70

Replace section 88-1.02P with:

01-18-13

88-1.02P Biaxial Geogrid

Geosynthetics used for biaxial geogrid must be a punched and drawn polypropylene material formed into an integrally formed biaxial grid. When tested under the referenced test methods, properties of biaxial geogrid must have the values shown in the following table:

Biaxial Geogrid

Property	Test	Value
Aperture size, inch ^a min and max	Calipered	0.8-1.3 x 1.0-1.6
Rib thickness, inch min	Calipered	0.04
Junction thickness, inch min	Calipered	0.150
Tensile strength, 2% strain, lb/ft ^a min	ASTM D 6637	410 x 620
Tensile strength at ultimate, lb/ft ^a min	ASTM D 6637	1,310 x 1,970
Ultraviolet resistance, percent min retained tensile strength, 500 hours	ASTM D 4355	100
Junction strength, lb/ft ^a min	ASTM D 7737	1,220 x 1,830
Overall flexural rigidity, mg-cm min	ASTM D 7748	750,000
Torsional rigidity at 20 cm-kg, mm-kg/deg ^b min	GRI:GG9	0.65

^aMachine direction x cross direction

^bGeosynthetic Research Institute, Test Method GG9, *Torsional Behavior of Bidirectional Geogrids When Subjected to In-Plane Rotation*

Replace section 88-1.02Q with:

07-19-13

88-1.02Q Geosynthetic Bond Breaker

Geosynthetic bond breaker must be nonwoven; needle punched; not heat treated; polypropylene, polyethylene material.

When tested under the referenced test methods, properties of geosynthetic bond breaker material must have the values shown in the following table:

Geosynthetic Bond Breaker		
Property	Test	Value
Mass per unit area, oz/sq yd min	ASTM D 5261	14.7
Thickness at 29 psi, mm min	ASTM D 5199	1.0
Tensile strength at ultimate, lbs/ft min	ASTM D 4595	685
Elongation, percent max	ASTM D 4595	130
Permittivity at 2.9 psi, m/s min	ASTM D 5493	0.0001
Hydraulic transmissivity at 29 psi, m/s min	ASTM D 6574	0.0002
Ultraviolet resistance, percent min retained grab breaking load, 500 hours	ASTM D 4355	60

AA

90 CONCRETE

07-19-13

Replace the 3rd paragraph of section 90-1.01C(7) with:

08-05-11

Submit weighmaster certificates in printed form or, if authorized, in electronic media. Present electronic media in a tab-delimited format on a CD or DVD. Captured data for the ingredients represented by each batch must be line feed carriage return and one line separate record with sufficient fields for the specified data.

Replace the 3rd paragraph of section 90-3.01C(5) with:

08-05-11

Production data must be input by hand into a pre-printed form or 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.

Replace the 1st paragraph of section 90-4.01A with:

07-19-13

Section 90-4 includes specifications for fabricating PC concrete members.

Replace the paragraphs in section 90-4.01C with:

07-19-13

90-4.01C(1) General

For reports and logs, type or clearly print the name next to the signature of the person signing the report or log.

Submit expansion test data under section 90-4.02, if required.

90-4.01C(2) Certificates of Compliance

Submit a certificate of compliance for the cementitious material used in PC concrete members. The certificate must be signed by the PC concrete product manufacturer.

Submit a certificate of compliance for each PC concrete member. The certificate of compliance for tier 1 and tier 2 members must be signed by the QC manager. The certificate of compliance for tier 3 members must be signed by the QC Inspector.

90-4.01C(3) Precast Concrete Quality Control Plan

Before performing any precasting activities for tier 1 and tier 2 PC concrete members, submit 3 copies of the project-specific QC plan for the PC plant. The QC plan must supplement the information from the authorized facility audit. Submit a separate QC plan for each plant. Allow 25 days for review.

Each project-specific QC plan must include:

1. Name of the precasting plant, concrete plants, and any testing laboratory to be used.
2. Manual prepared by the precasting plant that includes:
 - 2.1. Equipment description
 - 2.2. Testing procedures
 - 2.3. Safety plan
 - 2.4. Personnel names, qualifications, and copies of certifications
3. QC manager and QC inspector names, qualifications, and copies of certifications.
4. Organizational chart showing QC personnel and their assigned QC responsibilities.
5. Methods and frequencies for performing QC procedures including inspections, material testing, and any survey performed for all components of PC concrete members. Components include prestressing, concrete, grout, reinforcement, steel, miscellaneous metal, and formwork.
6. System for reporting noncompliant PC concrete members to the Engineer.
7. System for identification and tracking repairs and repair methods.
8. Procedure for the reinspection of repaired PC concrete members.
9. Forms for certificates of compliance, daily production logs, and daily reports.

Submit a revised QC plan for any changes to:

1. Concrete plants
2. Material sources
3. Material testing procedures
4. Testing laboratory
5. Procedures and equipment
6. Updated systems for tracking and identifying PC concrete members
7. QC personnel

After authorization, submit 7 copies of each authorized QC plan and make 1 copy available at each location where work is performed.

Allow 7 days for review of a revised QC plan.

90-4.01C(4) Daily Production Log

The QC inspector must provide reports to the QC manager for each day that precasting activities are performed.

The QC manager must maintain a daily production log of PC activities for each day's precasting. PC activities include setting forms, placing reinforcement, setting prestressing steel, casting, curing, post

tensioning, and form release. This daily log must be available at the precasting plant. The daily log must include:

1. Plant location
2. Specific description of casting or related activities
3. Any problems or deficiencies discovered
4. Any testing or repair work performed
5. Names of QC inspectors and the specific QC inspections they performed that day
6. Reports for that day's precasting activities from each QC inspector including before, during, and after precast inspections

Immediately notify the Engineer when any precasting problems or deficiencies are discovered, and submit the proposed repair or process changes necessary to correct them.

90-4.01C(5) Precast Concrete Report

Before shipping PC concrete members, submit a PC concrete report. The report must include:

1. Reports of all material tests and any survey checks
2. Documentation that:
 - 2.1. You have evaluated all tests
 - 2.2. You corrected all rejected deficiencies
 - 2.3. Repairs have been reexamined with the required tests and found acceptable
3. Daily production logs
4. Certificates of compliance
5. Documentation of inspections

Each person who performs a material test or survey check must sign the corresponding report and submit the report directly to the QC manager.

Replace the paragraphs in section 90-4.01D with:

07-19-13

90-4.01D(1) General

Quality control and assurance for PC concrete includes:

1. Your QC program
2. Department's acceptance of PC concrete members

PC concrete members are categorized into the following 4 tiers:

1. Tier 1 consists of:
 - 1.1. Components of bridge structures, including girders, deck panels, bent caps, abutments, slabs, closure wall panels, and piling
 - 1.2. Prestressed pavement
2. Tier 2 consists of:
 - 2.1. Components of earth retaining systems
 - 2.2. Wingwalls
 - 2.3. Types A, B, and C pipe culvert headwalls, endwalls, and wingwalls
 - 2.4. Pavement
 - 2.5. Box culverts
 - 2.6. Sound wall panels and supports
3. Tier 3 consists of:
 - 3.1. Pipes
 - 3.2. Pipe drainage facilities
 - 3.3. Straight and "L" pipe culvert headwalls except those listed under tier 2
 - 3.4. Drainage Inlets
 - 3.5. Flared end sections
4. Tier 4 consists of any member not described as tier 1, tier 2, or tier 3

90-4.01D(2) Quality Control

90-4.01D(2)(a) General

For tier 1 and tier 2 PC concrete members:

1. Fabricate PC concrete members at a plant on the Authorized Facility Audit List
2. Assign a PC concrete QC manager to the plant
3. Assign a QC inspector who is either registered as a civil engineer in the State or:
 - 3.1. For tier 1, has a Plant Quality Personnel Level II certification from the Precast/Prestressed Concrete Institute
 - 3.2. For tier 2, has a Plant Quality Personnel Level I certification from the Precast/Prestressed Concrete Institute
4. Prepare a PC concrete QC plan
5. Perform PC concrete materials testing
6. Maintain a daily production log
7. Prepare a PC concrete report
8. Prepare a certificate of compliance

For tier 3 PC concrete members:

1. Assign a QC inspector who has one of the following qualifications:
 - 1.1. Registration as a civil engineer in the State.
 - 1.2. Plant Quality Personnel, Level I certification from the Precast/Prestressed Concrete Institute.
 - 1.3. Competency to perform inspection of PC operations. An inspector is competent if the individual has completed training or has experience in PC operations and inspection.
2. Prepare a certificate of compliance

For tier 4 PC concrete members, prepare a certificate of compliance.

For each ASTM test method specified in this section, the material's test result must comply with the requirement specified for the comparable test in section 90 unless otherwise specified.

If curing compound is used, provide certificate of compliance as specified in section 90-1.01C(5).

If PC concrete is manufactured at an established PC concrete plant, a trial batch and prequalification of the materials, mix proportions, mixing equipment, and procedures under section 90-1.01D(5)(b) are not required.

90-4.01D(2)(b) Quality Control Meeting

After submitting the PC concrete QC plan, hold a meeting to discuss the requirements for PC concrete QC. The meeting attendees must include the Engineer, the PC concrete QC manager, and a representative from each plant performing PC concrete activities for the Contract.

90-4.01D(2)(c) Sampling, Testing, and Inspecting

The QC laboratory testing personnel or the QC inspector must witness sampling. The QC laboratory testing personnel must perform testing.

QC laboratory testing personnel must have the following certifications, as applicable:

1. ACI Strength Testing Technician
2. ACI Concrete Laboratory Testing Technician Level 1
3. ACI Aggregate Testing Technician Level 2

The QC Inspector must perform inspections before, during, and after casting is complete.

QC field testing and inspection personnel must have an ACI Concrete Field Testing Technician, Grade I certification.

For each mix design used for tier 1 and tier 2 PC concrete members, perform sampling and testing at the minimum frequencies shown in the following tables:

Aggregate QC Tests

Property	Test method	Minimum testing frequency
Aggregate gradation	ASTM C136	Once per 400 cu yd of concrete cast or once a week, whichever is more frequent
Sand equivalent	ASTM D2419	
Percent fines under 75 microns ^a	ASTM C117	
Moisture content of fine aggregate	ASTM C566, or electronically actuated moisture meter ^b	1–2 times per each day of pour, depending on conditions

^aPercent fines under 75 microns test replaces the cleanness test in section 90-1.02C with the requirements of 1.5 percent maximum for "Operating Range" and 2.0 percent maximum for "Contract Compliance." The 5th paragraph of section 90-1.02C(2) does not apply.

^bElectronically actuated moisture meter must be calibrated once per week per ASTM C566.

Concrete QC Tests

Property	Test method	Minimum testing frequency
Compressive strength ^b	ASTM C172/C172M, ASTM C31/C31M, and ASTM C39/C39M	Once per 100 cu yd of concrete cast, or every day of casting, whichever is more frequent
Slump	ASTM C143/C143M	
Temperature	ASTM C1064/C1064M	
Density	ASTM C138	Once per 600 cu yd of concrete cast or each week of batching, whichever is more frequent
Air content	ASTM C231/C231M or ASTM C173/C173M ^a	If concrete is air entrained, once for each set of cylinders, and when conditions warrant

^aASTM C173/C173M must be used for lightweight concrete.

^bCylinders must be 6 by 12 inches.

If concrete is batched at more than 1 plant, perform the tests at each plant.

Cure test cylinders for determining time of prestressing loading in the same manner as the concrete in the member.

Cure test cylinders for determining compliance with 28-day strength requirements in the same manner as the member until completion of the steam curing process followed by a water bath or moist room at 60 to 80 degrees F until tested.

92 ASPHALTS

07-19-13

Replace "Reserved" in section 92-1.01B with:

07-19-13

modified asphalt binder: Asphalt binder modified with polymers, crumb rubber, or both.

Replace the row for dynamic shear for original binder in the table in the 1st paragraph of section 92-1.02B with:

01-20-12

Dynamic shear, Test temperature at 10 rad/s, °C	T 315	58	64	64	64	70
min $G^*/\sin(\delta)$, kPa		1.00	1.00	1.00	1.00	1.00
max $G^*/\sin(\delta)$, kPa		2.00	2.00	2.00	2.00	2.00

Replace 2nd paragraph of section 92-1.02B with:

07-19-13

PG modified asphalt binder must comply with the requirements shown in the following table:

PG Modified Asphalt Binder

Property	AASHTO Test Method	Grade		
		PG 58–34 M	PG 64–28 M	PG 76–22 M
Original Binder				
Flash point, min °C	T 48	230	230	230
Solubility, min %	T 44 ^a	97.5	97.5	97.5 ^b
Viscosity at 135 °C ^c , max, Pa·s	T 316	3.0	3.0	3.0
Dynamic shear, Test temperature at 10 rad/s, °C min G*/sin(delta), kPa	T 315	58 1.00	64 1.00	76 1.00
RTFO test ^d , Mass loss, max, %	T 240	1.00	1.00	1.00
RTFO Test Aged Binder				
Dynamic shear, Test temperature at 10 rad/s, °C min G*/sin(delta), kPa	T 315	58 2.20	64 2.20	76 2.20
Dynamic shear, Test temperature at 10 rad/s, °C max (delta), degree	T 315	80 ^e	80 ^e	80 ^e
Elastic recovery ^f , Test temperature °C min recovery, %	T 301	25 75	25 75	25 65
PAV ^g , temperature, °C	R 28	100	100	110
RTFO Test and PAV Aged Binder				
Dynamic shear, Test temperature at 10 rad/s, °C max G*sin(delta), kPa	T 315	16 5000	22 5000	31 5000
Creep stiffness, Test temperature, °C max S-value, MPa min M-value	T 313	-24 300 0.300	-18 300 0.300	-12 300 0.300

