08

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

NOTICE TO BIDDERS

AND

SPECIAL PROVISIONS

FOR CONSTRUCTION ON STATE HIGHWAY IN RIVERSIDE COUNTY ON ROUTE 215 IN MURRIETA FROM 0.5 MILES SOUTH OF 215/15 SEPARATION TO 0.5 NORTH MILE NORTH OF 215/60 SEPARATION IN MORENO VALLEY

In District 08 On Route 215

Under

***Bid* book dated December 7, 2015**	***Standard Specifications* dated 2010**
Project plans approved June 30, 2015	***Standard Plans* dated 2010**

Identified by

Contract No. 08-0G7804

08-Riv-215-8.4/38.8

Project ID 0814000173

Federal-Aid Project
ACNHPI-215-1(239)E

Electronic Bidding Contract

AADD

Bids open Thursday, January 21, 2016
Dated December 7, 2015

IH

****

SPECIAL NOTICES

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- See sections 2 and 3 for contractors' registration requirements.

CONTRACT NO. 08-0G78014

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

HIGHWAYS

6/16/15

REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
DAT D. VY
No. C76537
Exp. 12/31/16
CIVIL
STATE OF CALIFORNIA

TRAFFIC

6/16/15

REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
DEAN D TO
No. C81698
Exp. 03/31/16
CIVIL
STATE OF CALIFORNIA

ELECTRICAL

6/16/15

REGISTERED ELECTRICAL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
MOHAMMED ELEIWAT
No. E19650
Exp. 09/30/15
ELECT.
STATE OF CALIFORNIA

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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)
RSP A77L1	Midwest Guardrail System Standard Railing Section (Wood Post with Wood Block)
RSP A77M1	Midwest Guardrail System Standard Hardware
RSP A77N1	Midwest Guardrail System Wood Post and 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 A77N5	Midwest Guardrail System Typical Vegetation Control Standard Railing Section
RSP A77N6	Midwest Guardrail System Typical Vegetation Control for Terminal System End Treatments
RSP A77N8	Midwest Guardrail System Typical Vegetation Control at Fixed Object
RSP A77P1	Midwest Guardrail System Typical Layouts for Embankments
RSP A77Q1	Midwest Guardrail System Typical Layouts for Structure Approach
RSP A77R3	Midwest Guardrail System Typical Layouts for Roadside Fixed Objects
RSP A77S1	Midwest Guardrail System End Anchor Assembly (Type SFT)
RSP A77S3	Metal Railing Anchor Cable and Anchor Plate Details
RSP A77U4	Midwest Guardrail System Transition Railing (Type WB-31)
RSP A85	Chain Link Fence
RSP A85B	Chain Link Fence Details
RSP P74	Pavement Edge Treatments
RSP P75	Pavement Edge Treatments - Overlays
RSP H1	Landscape and Erosion Control Abbreviations
RSP H9A	Landscape Details
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 T10	Traffic Control System for Lane Closure on Freeways and Expressways
RSP T10A	Traffic Control System for Lane Closures on Freeways and Expressways
T56	Temporary Water Pollution Control Details (Temporary Fiber Roll)
T58	Temporary Water Pollution Control Details (Temporary Construction Entrance)
T61	Temporary Water Pollution Control Details (Temporary Drainage Inlet Protection)
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)]
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
RSP ES-1A	Electrical Systems (Legend and Abbreviations)
RSP ES-1B	Electrical Systems (Legend and Abbreviations)
RSP ES-1C	Electrical Systems (Legend and Abbreviations)
RSP ES-2C	Electrical Systems (Service Equipment Enclosure Notes, Type III Series)
RSP ES-2F	Electrical Systems (Service Equipment Enclosure and Typical Wiring Diagram Type III - C Series)
RSP ES-3C	Electrical Systems (Controller Cabinet Foundation and Pad Details)
RSP ES-7B	Electrical Systems (Signal and Lighting Standard, Type 1 and Equipment Identification Characters)
RSP ES-8A	Electrical Systems (Non-Traffic Pull Box)
RSP ES-8B	Electrical Systems (Traffic Pull Box)
RSP ES-9B	Electrical Systems (Conduit Riser and Expansion Fitting, Structure Installations)
RSP ES-11	Electrical Systems (Foundation Installations)
RSP ES-13A	Electrical Systems (Splicing Details)
ES-13B	Electrical Systems (Fuse Rating, Kinking and Banding Detail)
RSP ES-16B	Electrical Systems (Closed Circuit Television, 25' to 45' Pole)
RSP ES-16D	Electrical Systems (Closed Circuit Television with Vehicle Detection System, 30' to 40' 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-6H	07-19-13
A77A2	07-19-13	A77K1	07-19-13	ES-6I	07-19-13
A77B1	07-19-13	A77K2	07-19-13	ES-6J	07-19-13
A77C1	07-19-13	P3	07-19-13	ES-7I	07-19-13
A77C2	07-19-13	C8A	07-19-13	ES-8	01-20-12
A77C3	07-19-13	C8B	07-19-13	ES-10	07-20-12
A77C4	07-19-13	C8C	07-19-13	ES-12A	10-30-15
RSP A77C5	07-19-13	D98D	10-30-15	ES-12B	10-30-15
RSP A77C6	07-19-13	D98E	10-30-15		
RSP A77C7	07-19-13	B3-1	04-20-12		
RSP A77C8	07-19-13	B3-2	04-20-12		
RSP A77C9	07-19-13	B3-3	04-20-12		
RSP A77C10	07-19-13	B3-4	04-20-12		
A77E1	07-19-13	B3-7	04-20-12		
A77E2	07-19-13	B3-8	04-20-12		
A77E3	07-19-13	S7	07-19-13		
A77E4	07-19-13	S14	07-19-13		
A77E5	07-19-13	S41	07-19-13		
A77E6	07-19-13	S42	07-19-13		
A77F1	07-19-13	S43	07-19-13		
A77F2	07-19-13	S44	07-19-13		
A77F3	07-19-13	S45	07-19-13		
A77F4	07-19-13	S46	07-19-13		
A77F5	07-19-13	S47	07-19-13		
A77G1	07-19-13	S120	07-19-13		
A77G2	07-19-13	S121	07-19-13		
A77G3	07-19-13	S122	07-19-13		
A77G4	07-19-13	S123	07-19-13		
A77G5	07-19-13	S124	07-19-13		
A77G6	07-19-13	S125	07-19-13		
A77G7	07-19-13	S126	07-19-13		
A77G8	07-19-13	S127	07-19-13		
A77H1	07-19-13	S128	07-19-13		
A77H2	07-19-13	S129	07-19-13		
A77H3	07-19-13	S130	07-19-13		
A77I1	07-19-13	S131	07-19-13		
A77I2	07-19-13	S132	07-19-13		
A77J1	07-19-13	S133	07-19-13		
A77J2	07-19-13	S134	07-19-13		
A77J3	07-19-13	S135	07-19-13		

NOTICE TO BIDDERS

Bids open Thursday, January 21, 2016

Dated December 7, 2015

General work description: INSTALL CCTV, CMS, CENSUS STATIONS, DETECTIONS, HUBS.

The Department will receive sealed bids for CONSTRUCTION ON STATE HIGHWAY IN RIVERSIDE COUNTY ON ROUTE 215 IN MURRIETA FROM 0.5 MILES SOUTH OF 215/15 SEPARATION TO 0.5 NORTH MILE NORTH OF 215/60 SEPARATION IN MORENO VALLEY.

District-County-Route-Post Mile: 08-Riv-215-8.4/38.8

Contract No. 08-0G7804

The Contractor must have either a Class A license or one of the following Class C licenses: C-10.

The DBE Contract goal is 13 percent.

Federal-aid project no.:

ACNHPI-215-1(239)E

Bids must be on a unit price basis.

Complete the work within 240 working days.

The estimated cost of the project is $7,100,000.

No prebid meeting is scheduled for this project.

The Department will receive bids until 2:00 p.m. on the bid open date via Bid Express web site. Bids received after this time will not be accepted. For more information refer to the Electronic Bidding Guide at the Bidders' Exchange web site.

The Department will open and publicly read the bids at 1727 30th Street, Bidders' Exchange, MS 26, Sacramento, CA 95816 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.

Caltrans and the Construction Industry are committed to making partnering the way we do business. For more information, go to http://www.dot.ca.gov/hq/construc/partnering.html.

Department of Transportation

D08B.S.

BID ITEM LIST

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
1	070030	LEAD COMPLIANCE PLAN	LS	LUMP SUM
2	090100	TIME-RELATED OVERHEAD (WDAY)	WDAY	240
3	120090	CONSTRUCTION AREA SIGNS	LS	LUMP SUM
4	120100	TRAFFIC CONTROL SYSTEM	LS	LUMP SUM
5	120165	CHANNELIZER (SURFACE MOUNTED)	EA	66
6	128651	PORTABLE CHANGEABLE MESSAGE SIGN (EA)	EA	2
7	129000	TEMPORARY RAILING (TYPE K)	LF	3,600
8	129100	TEMPORARY CRASH CUSHION MODULE	EA	95
9	130100	JOB SITE MANAGEMENT	LS	LUMP SUM
10	130300	PREPARE STORM WATER POLLUTION PREVENTION PLAN	LS	LUMP SUM
11	130330	STORM WATER ANNUAL REPORT	EA	2
12	130620	TEMPORARY DRAINAGE INLET PROTECTION	EA	50
13	130640	TEMPORARY FIBER ROLL	LF	500
14	130650	TEMPORARY GRAVEL BAG BERM	LF	400
15	130710	TEMPORARY CONSTRUCTION ENTRANCE	EA	2
16	130730	STREET SWEEPING	LS	LUMP SUM
17	130900	TEMPORARY CONCRETE WASHOUT	LS	LUMP SUM
18	141000	TEMPORARY FENCE (TYPE ESA)	LF	370
19	141120	TREATED WOOD WASTE	LB	1,200
20	150771	REMOVE ASPHALT CONCRETE DIKE	LF	960

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
21	151296	SALVAGE GUARDRAIL	LF	63
22	160102	CLEARING AND GRUBBING (LS)	LS	LUMP SUM
23	190101	ROADWAY EXCAVATION	CY	270
24	190185	SHOULDER BACKING	TON	30
25	210430	HYDROSEED	SQFT	654,000
26	260203	CLASS 2 AGGREGATE BASE (CY)	CY	140
27	390100	PRIME COAT	TON	0.6
28	390132	HOT MIX ASPHALT (TYPE A)	TON	210
29	397005	TACK COAT	TON	0.2
30	498052	60" CAST-IN-DRILLED-HOLE CONCRETE PILE (SIGN FOUNDATION)	LF	44
31	560218	FURNISH SIGN STRUCTURE (TRUSS)	LB	30,600
32	560219	INSTALL SIGN STRUCTURE (TRUSS)	LB	30,600
33	832007	MIDWEST GUARDRAIL SYSTEM (WOOD POST)	LF	530
34	832070	VEGETATION CONTROL (MINOR CONCRETE)	SQYD	320
35	839543	TRANSITION RAILING (TYPE WB-31)	EA	1
36	839581	END ANCHOR ASSEMBLY (TYPE SFT)	EA	2
37	839584	ALTERNATIVE IN-LINE TERMINAL SYSTEM	EA	2
38	839585	ALTERNATIVE FLARED TERMINAL SYSTEM	EA	1
39	860090	MAINTAINING EXISTING TRAFFIC MANAGEMENT SYSTEM ELEMENTS DURING CONSTRUCTION	LS	LUMP SUM
40	030364	MODIFY WIRELESS VEHICLE DETECTION SYSTEM(SOLAR)	EA	14

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
41	030365	MODIFY WIRELESS VEHICLE DETECTION SYSTEM(AC POWER)	EA	17
42	030366	CLOSED CIRCUIT TELEVISION SYSTEM (CCTV)	EA	8
43	030367	MODIFY CLOSED CIRCUIT TELEVISION SYSTEM (CCTV)	EA	4
44	030368	MODIFY ELECTRIC SERVICE	LS	LUMP SUM
45	030369	CHANGEABLE MESSAGE SIGN SYSTEM (CMS) (LOCATION 1)	LS	LUMP SUM
46	030370	CHANGEABLE MESSAGE SIGN SYSTEM (CMS) (LOCATION 2)	LS	LUMP SUM
47	030371	FIBER OPTIC COMMUNICATION SYSTEM	LS	LUMP SUM
48	030372	VEHICLE SENSOR NODE (VSN) REPLACEMENT	EA	18
49	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*.

^^

DIVISION I GENERAL PROVISIONS

1 GENERAL

Add to section 1-1.01:

Bid Items and Applicable Sections

Item code	Item description	Applicable section
030364	MODIFY WIRELESS VEHICLE DETECTION SYSTEM (SOLAR)	86
030365	MODIFY WIRELESS VEHICLE DETECTION SYSTEM (AC POWER)	86
030366	CLOSED CIRCUIT TELEVISION SYSTEM (CCTV)	86
030667	MODIFY CLOSED CIRCUIT TELEVISION SYSTEM (CCTV)	86
030368	MODIFY ELECTRIC SERVICE	86
030369	CHANGEABLE MESSAGE SIGN SYSTEM (CMS) (LOCATION 1)	86
030370	CHANGEABLE MESSAGE SIGN SYSTEM (CMS) (LOCATION 2)	86
030371	FIBER OPTIC COMMUNICATION SYSTEM	86
030372	VEHICLE SENSOR NODE (VSN) REPLACEMENT	86

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2 BIDDING

Add between the 1st and 2nd paragraphs of section 2-1.06B:

The Department makes the following supplemental project information available:

Supplemental Project Information

Means	Description
Included in the *Information Handout*	1. Riverside County Transportation Commission License Agreement No. 15-33-109-00. 2. Memorandum Of Understanding Fiber Optic Cable Agreement. 3. Metrolink Clearance Memo. 4. Metrolink-Temporary Right-Of-Entry Agreement, form No. 6. 5. Metrolink-Schedule Of Fees. 6. Metrolink-Exhibit "A", Insurance Requirements for Right Of Way Agreements.

^^

5 CONTROL OF WORK

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
0A0204	Riv-215-15.5	SCOTT ROAD	MODIFY IC
0J4404	Riv-215-18.5	NEWPORT ROAD	MODIFY IC
0Q6704	Riv-215-18.5	NUEVO	MODIFY IC

^^

6 CONTROL OF MATERIALS

Add to section 6-2.03:

The Department furnishes you with:

- Model 342LX Controller Cabinet
- Model 500 Changeable Message Sign Controller Cabinet and Wiring Harness

The Department furnishes you with completely wired controller cabinets with auxiliary equipment but without controller unit at District 8 Maintenance Yard, 175 West Cluster Street, San Bernardino, CA 92408. 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.

The Department furnishes you with a Model 500 changeable message sign, wiring harness, and controller assembly, including the controller unit and completely wired cabinet, at District 8 Maintenance Yard, 175 West Cluster Street, San Bernardino, CA 92408. 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.

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

Lead is typically found within the top 2 feet of material in unpaved areas of the highway. Reuse all of the excavated material on the right-of-way.

Handle the material under all applicable laws, rules, and regulations, including those of the following agencies:

1. Cal/OSHA
2. CA RWQCB, Region 8- Santa Ana
3. CA Department of Toxic Substances Control

8 PROSECUTION AND PROGRESS

Replace "Reserved" in section 8-1.04C with:

Section 8-1.04B does not apply.

Start job site activities within 120 days after receiving notice that the Contract has been approved by the Attorney General or the attorney appointed and authorized to represent the Department.

Do not start job site activities until the Department authorizes or accepts your submittal for:

1. CPM baseline schedule
2. WPCP or SWPPP, whichever applies
3. Notification of DRA or DRB nominee and disclosure statement

You may enter the job site only to measure controlling field dimensions and locate utilities.

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.

You may start job site activities before the 120th day after Contract approval if you:

1. Obtain specified authorization or acceptance for each submittal before the 120th 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.

^^

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. Camera Assemblies
2. Fiber Optic Cable
3. Fiber Optic Conduit
4. Innerduct
5. Splice Vault
6. Furnish Sign Structure
7. Midwest Guardrail System

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DIVISION II GENERAL CONSTRUCTION

12 TEMPORARY TRAFFIC CONTROL

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. Shoulder closure

Add to section 12-4.02A:

If work, including installing, maintaining, and removing Type K temporary railing, is to be performed within 6 feet of the adjacent traffic lane, close the adjacent traffic lane.

Except as listed above, closure of the adjacent traffic lane is not required for installing, maintaining, and removing traffic control devices.

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.

The special days are Martin Luther King Jr. Day, Cesar Chavez Day, Good Friday thru Easter Sunday, Day after Thanksgiving, December 20 thru January 2.

The maximum length of the work area inside a lane closure other than a one-way-reversing traffic-control lane closure is 2 miles.

Not more than 2 stationary lane closures will be allowed in each direction of travel at one time. Concurrent stationary closures in the same direction of travel must be spaced no closer than 2 miles apart. Closures in the same direction of travel on alternating inside lane/outside lanes must be spaced by an additional 0.5 miles.

Personal vehicles of your employees must not be parked on the traveled way or shoulders, including sections closed to traffic.

If work vehicles or equipment are parked within 6 feet of a traffic lane, close the shoulder area as described.

A minimum of 1 paved traffic lane not less than 10 feet wide must be open for use by traffic in each direction of travel.

If a connector closure is required within the limits of a freeway lane closure, complete the work on the connector first. Then, complete the work on the freeway traveled way necessary to ensure safe passage of traffic between the connector and open freeway lanes. Complete the remaining work only after reopening the connector.

District 8's List of Special Events

No work that encroaches onto the traveled way of the affected Routes shall be allowed from 3 hours before to 2 hours following special events listed below unless otherwise permitted by the District Traffic Manager.

Venue/Special Events	Affected Routes	Route Impact	Route Limits	Presently Identified The Month Of Events	Website	Contact #
San Manuel Amphitheater (Glen Helen)	215 15	*** **	University Pkwy to I-15/215 Connector I-60 to Devore Road	Various events May-Oct yearly See web site	www.sanmanuelamphitheater.com	(909) 880-6500
Redland Bicycle Classic	38	***	SR-38 from Fawnskin to Stanfield Cut-off	April	www.redlandsclassic.com	
Amgen Tour of California	18 38		Big Bear Lake	May	www.amgentourofcalifornia.com	
Auto Club Speedway (California)	10 15 210 66 60	*** *** *** *** ***	LA I-57 to SBD I-215 I-15/215 to SR-91 Haven to I-215 Haven to Cherry I-15 to County Line	Various events Thru the year See web site	www.autoclubspeedway.com	(909) 429-5000
Temecula Balloon and Wine Festival	15	**	SR-79 (Winchester Rd) and Rancho California	June	www.tvbwf.com	(951) 676-6713
Bob Hope/Chrysler Classic	10	**	Palm Springs off ramp at SR-111	January	www.bhcc.com	(760) 346-6329
Kraft Nabisco Championship	10	**	Palm Springs off ramp at SR-111	March	http://www.kncgolf.com	(760) 324-4546
Festival of Lights (Downtown Riverside)	91	**	I-15 to I-215/SR-60 split	November	http://www.riversidedowntown.org/	(951) 683-7100
March Air Show March Air Reserve Base	215	***	Cactus to Ramona Express Way	May	http://www.marchfieldairfest.com	(951) 655-1110
UCR Graduation	60 215	*** ***	I-215/SR-60/SR-91 split to Central Ave	June	www.commencement.ucr.edu	(951) 787-3144
Laughlin River Run	40	***	I-40/ From I-15 to Arizona State Line	April	http://www.laughlinriverrun.com	(949) 502-3434
Thunder & Lightning Powwow	10	***	I-10/ Morongo Valley	September	http://www.morongocasinoresort.com/pow2.cfm	(800) 252-4499 ext.#: 23800

** Designates Moderate Impact (20 minute delay or less)

*** Designates High Impact (30 minute delay or less)

Note 1: The dates of events change yearly. Contact Ph. numbers and websites are provided to verify exact dates.

Note 2: Other special events do exist that impact our freeway and highway system. Close coordination with the local agencies and other impacted entities must be carried out before conducting work that requires full or partial closures.

Replace "Reserved" in section 12-4.04 with:

Lane Closure Restriction for Designated Holidays and Special Days

Thu	Fri	Sat	Sun	Mon	Tues	Wed	Thu	Fri	Sat	Sun
x	**H** xx	xx	xx							
	SD xx									
x	xx	**H** xx	xx							
		SD xx								
	x	xx	**H** xx	xx						
			SD xx							
	x	xx	xx	**H** xx	xxx					
	x	xx	xx	**SD** xx	xxx					
				x	**H** xx					
				x	**SD** xx					
					x	**H** xx				
						SD xx				
						x	**H** xx	xx	xx	xx
							SD xx			

Legend:

	Refer to lane requirement charts
x	The full width of the traveled way must be open for use by traffic after 6:00.
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 18:00.
H	Designated holiday
SD	Special day

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

Chart no. 1
Freeway/Expressway Lane Requirements

County: Riv	Route/Direction: 215/NB	PM: R8.4/R38.8

Closure limits:

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	2		S	S	S	S	S	S	S	S	S							2	2	
Fri	1	1	1	1	1			S	S	S	S	S	S	S	S	S							2	2	
Sat	1	1	1	1	1	2		S	S	S	S	S	S	S	S	S							1	1	
Sun	1	1	1	1	1	2	2	S	S	S	S	S	S	S	S	S								1	

Legend:

1	Provide at least 1 through freeway lane open in direction of travel
2	Provide at least 2 adjacent through freeway lanes open in direction of travel
S	Shoulder closure allowed (right)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS:

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

Chart no. 2
Freeway/Expressway Lane Requirements

County: Riv	Route/Direction: 215/SB	PM: R8.4/R38.8

Closure limits:

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			S	S	S	S	S	S	S	S	S						2	2	2	
Fri	1	1	1	1	1	2		S	S	S	S	S	S	S	S	S							2	2	
Sat	1	1	1	1	1	1		S	S	S	S	S	S	S	S	S							2	1	
Sun	1	1	1	1	1	2		S	S	S	S	S	S	S	S	S							2	2	

Legend:

1	Provide at least 1 through freeway lane open in direction of travel
2	Provide at least 2 adjacent through freeway lanes open in direction of travel
S	Shoulder closure allowed (right)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS:

Replace "Reserved" in section 12-5 with:

12-5.01 GENERAL

Section 12-5 includes specifications for closing traffic lanes, ramps, or a combination with stationary lane closures on multilane highways.

A traffic control system for a closure includes the temporary traffic control devices described as part of the traffic control system. The temporary traffic control devices must comply with section 12-3.

12-5.02 MATERIALS

Not Used

12-5.03 CONSTRUCTION

Each vehicle used to place, maintain, and remove components of a traffic control system on a multilane highway must be equipped with a Type II flashing arrow sign that must be in operation whenever the vehicle is being used for placing, maintaining, or removing the components. Vehicles equipped with a Type II flashing arrow sign not involved in placing, maintaining, or removing the components if operated within a stationary-type lane closure must display only the caution display mode. The sign must be controllable by the operator of the vehicle while the vehicle is in motion. If a flashing arrow sign is required for a lane closure, the flashing arrow sign must be operational before the lane closure is in place.

Whenever components of the traffic control system are displaced or cease to operate or function as specified from any cause, immediately repair the components to the original condition or replace the components and restore the components to the original location.

For a stationary lane closure, ramp closure, or a combination made only for the work period, remove the components of the traffic control system from the traveled way and shoulder at the end of each work period except for portable delineators placed along open trenches or excavation adjacent to the traveled way. You may store the components at selected central locations designated by the Engineer within the limits of the highway.

12-5.04 PAYMENT

A traffic control system for a lane closure is paid for as traffic control system.

The requirements in section 4-1.05 for payment adjustment do not apply to traffic control system. Adjustments in compensation for traffic control system will be made for an increase or decrease in traffic control work if ordered and will be made on the basis of the cost of the necessary increased or decreased traffic control. The adjustment will be made on a force account basis for increased work and estimated on the same basis in the case of decreased work.

A traffic control system required by change order work is paid for as a part of the change order work.

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13 WATER POLLUTION CONTROL

Add to section 13-3.01A:

The project is risk level 1.

^^

14 ENVIRONMENTAL STEWARDSHIP

Add to section 14-1.02A:

An ESA exists on this project.

Before start of work, protect the ESA by installing Temporary Fence (Type ESA).

Limited access to the ESA is allowed for water sampling. Notify the Engineer 3 business days before the planned entry date. Any other access to an ESA is prohibited.

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 August 31.

Replace section 14-6.06 with:

14-6.06 SPECIES PROTECTION AREA

14-6.06A General

14-6.06A(1) Summary

Section 14-6.06 includes specifications for areas that have species protection requirements.

Species protection areas (SPAs) within the project limits are shown:

Species Protection Areas

Identification	Location
SPA 1	Entire project limits

14-6.06B Materials

Not Used

14-6.06C Construction

Not Used

14-6.06D Payment

Not Used

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 guardrail 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 California disposal site operating under a RWQCB permit that includes acceptance of TWW.

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

Replace "Reserved" in section 14-11.10 with:

14-11.10A General

Section 14-11.10 includes specifications for disposing of electrical equipment containing hazardous materials.

14-11.10B Waste Management

14-11.10B(1) Universal Waste

Batteries, mercury lamps, and fluorescent tubes, bulbs, and lamps are universal waste. Manage universal waste under 22 CA Code Regs § 66261.9.

Transport mercury lamps and fluorescent tubes, bulbs, and lamps to an appropriately permitted disposal facility.

Vehicle sensor nodes (VSN) contain lithium thionyl chloride (LTC) batteries. Thionyl chloride is designated as an extremely hazardous waste under 22 CA Code of Regs, Div 4.5, Ch 11, Art 5, App 10. Each VSN includes 1 integral LTC battery.

Package removed VSNs containing undamaged LTC batteries and place the packages in sealed shipping containers. Transport the containers to a recycling or disposal facility. Notify the receiving facility 48 hours before delivery. Affix a label to containers of intact VSNs identifying the contents as "Universal Waste: Lithium Thionyl Chloride Batteries."

Ship VSN batteries that are separated from a VSN to a recycling or disposal facility under 49 CFR 173.185. Package the batteries such that contact between them and resulting short circuits are avoided. Prevent accidental contact between batteries by:

1. Covering terminal ends to prevent them from touching each other
2. Placing batteries in a sealed plastic bag packed with loose fill, such as vermiculite

The outer packaging must comply with 49 CFR 173.24 and 173.24a. Transport LTC batteries to an approved hazardous waste recycling or disposal facility. For a partial list of facilities, go to:

http://www.dtsc.ca.gov/HazardousWaste/upload/LIST_HWM_Commercial_Facilities.pdf

or

http://www.calrecycle.ca.gov/Electronics/Recovery/Approved/Default.htm

14-11.10B(2) Fluorescent Light Ballasts Containing PCBs

Not Used

14-11.10C Damaged Electrical Equipment

Electrical equipment found damaged is a Department-generated hazardous waste. Use a hazardous waste manifest to transport damaged equipment to an appropriately permitted disposal facility.

Damaged electrical equipment containing PCBs or thionyl chloride, is designated as extremely hazardous waste.

You are the generator of hazardous waste produced by damage of electrical equipment through your own mishandling. You are responsible for cleanup, management, and disposal of this hazardous waste.

14-11.10D Payment

Management of Department-generated hazardous waste is change order work.

You are responsible for the cost of cleanup, management, and disposal of hazardous waste generated by mishandling electrical equipment.

^^

15 EXISTING FACILITIES

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
2. District Maintenance at telephone number (909) 887-9209

The salvage storage location is:

451 West Slover Ave
Bloomington, CA 92316

Replace section 15-2.03B with:

15-2.03B Salvage Guardrail

Salvaging guardrail includes removing concrete anchors, steel foundation tubes, and terminal anchor assemblies.

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39 HOT MIX ASPHALT

Replace section 39-1.03C(3) of the RSS for section 39 with:

39-1.03C(3) Prime Coat

Apply a slow-setting asphaltic emulsion as a prime coat to aggregate base areas designated by the Engineer. Apply prime coat at a spread rate of 0.15 to 0.40 gal/sq yd. Do not apply more prime coat than can be absorbed completely by the aggregate base in 24 hours.

If you request and the request is authorized, you may modify prime coat application rates.

Close areas receiving prime coat to traffic. Do not track prime coat onto pavement surfaces beyond the job site.

Replace section 39-1.03L of the RSS for section 39 with:

39-1.03L Roadside Paving

Construct roadside paving using HMA specified for miscellaneous areas.

Earthwork for roadside paving must comply with section 19. The grading plane must not be more than 0.05 foot above the grade determined by the Engineer. A relative compaction of not less than 95 percent must be obtained for a minimum depth of 0.5 foot below the grading plane.

Dispose of surplus excavated material, except as specified in section 14-11.

The aggregate base must comply with section 26-1.02B. Use 3/4-inch maximum aggregate gradation. Place aggregate base to a minimum compacted thickness of 0.5 foot.

If underground irrigation facilities are to be installed in areas to receive surfacing, install the facilities before placing HMA surfacing.

^^

83 RAILINGS AND BARRIERS

Replace "Reserved" in section 83-1.02B(1) with:

83-1.02B(1)(a) General

83-1.02B(1)(a)(i) Summary

Section 83-1.02B(1) includes specifications for constructing vegetation control areas around midwest guardrail system, metal beam guardrail to be reconstructed, and thrie beam barrier posts using minor concrete.

83-1.02B(1)(a)(ii) Definitions

Not Used

83-1.02B(1)(a)(iii) Submittals

Submit a mix design for the minor concrete to be used. The mix design must show proportions of:

1. Coarse aggregate
2. Fine aggregate
3. Cementitious material
4. Reinforcing fiber
5 Water

Include compressive strength test results with your mix design.

Submit the quantity in pounds of crumb rubber aggregate with your certificate of compliance for crumb rubber aggregate if used.

83-1.02B(1)(a)(iv) Quality Control and Assurance

Not Used

83-1.02B(1)(b) Materials

83-1.02B(1)(b)(i) General

Not Used

83-1.02B(1)(b)(ii) Minor Concrete

Minor concrete must include reinforcing fibers and may include crumb rubber aggregate.

Section 90-2.02B does not apply. Minor concrete must contain at least:

1. 505 pounds of cementitious material per cubic yard if crumb rubber aggregate is used
2. 400 pounds of cementitious material per cubic yard if crumb rubber aggregate is not used

The 3rd paragraph of section 90-2.02C does not apply. Minor concrete must have a maximum aggregate size of 3/8 inch.

All ingredients must be added at the concrete plant before delivery to the job site.

You may use volumetric proportioning under ASTM C 685/C 685M or section 90-3.02B.

Minor concrete must have a 28-day compressive strength from 1,400 to 1,800 psi.

83-1.02B(1)(b)(iii) Crumb Rubber Aggregate

Crumb rubber aggregate must consist of ground or granulated scrap tire rubber from automobile and truck tires. Tire buffings are not allowed. Crumb rubber aggregate must be ground and granulated at ambient temperature.

The gradation of the crumb rubber aggregate must comply with the requirements shown in the following table:

Gradation Requirements

Sieve size	Percentage passing
1/2"	100
3/8"	90–100
1/4"	35–45
No. 4	5–15
No. 8	0–5
No. 16	0

Crumb rubber aggregate must not contain more than 0.01 percent of wire by mass of crumb rubber and must be free of oils and volatile organic compounds.

Commingling of crumb rubber from different sources is not allowed.

The crumb rubber aggregate must be 3.5 ± 0.5 percent by weight of the concrete.

83-1.02B(1)(b)(iv) Reinforcing Fibers

Reinforcing fibers for minor concrete must be:

1. Manufactured specifically for use as concrete reinforcement from one of the following:
   1.1. Polypropylene, polyethylene, or a combination of both.
   1.2. Copolymer of polypropylene and polyethylene.
2. Blended ratio from 4 to 5.67 parts by weight of macro synthetic fibers to 1 part by weight of micro synthetic fibers. Synthetic fibers must be:
   2.1. Nonfibrillated macro fibers with individual fiber lengths less than 2 ± 1/2 inch.
   2.2. Fibrillated or monofilament micro fibers of various lengths and thicknesses.
3. Supplied in sealed, degradable bags of appropriate size for adding whole bags to concrete batches.
4. From a commercial source.

The reinforcing fiber content of minor concrete must be from 5 to 6 lb/cu yd.

83-1.02B(1)(b)(v) Coloring Agent

If a color for concrete is specified in section 83-1.02B(1)(b)(i), the coloring agent must be integral to the concrete mix and added at the concrete plant.

83-1.02B(1)(b)(vi) Block-Out Material

Use a commercially available expanded polystyrene foam for the block-out material. The expanded polystyrene foam must have a compressive strength of 13 ± 5 psi at 10 percent deformation when tested under ASTM D1621.

You may substitute an alternative material that meets the compressive strength requirements of the expanded polystyrene foam if authorized.

83-1.02B(1)(c) Construction

83-1.02B(1)(c)(i) General

Areas to receive vegetation control must be cleared of vegetation, trash, and debris. Dispose of removed material.

83-1.02B(1)(c)(ii) Earthwork

Excavate areas to receive vegetation control. Where vegetation control abuts the existing surfacing, the edge of the existing surfacing must be on a neat line or must be cut on a neat line to a minimum depth of 2 inches before removing the surfacing. The finished elevation of the excavated area to receive vegetation control must maintain planned flow lines, slope gradients, and contours of the job site.

Grade areas to receive vegetation control to a smooth, uniform surface and compact to a relative compaction of not less than 95 percent.

Dispose of surplus excavated material uniformly along the adjacent roadway except as specified in section 14-11.

83-1.02B(1)(c)(iii) Block Out

If block-out material is supplied in more than 1 piece, tape the pieces together to make a smooth surface on the top and sides.

Ensure block-out material does not move during concrete placement.

83-1.02B(1)(c)(iv) Placing Minor Concrete

Place minor concrete for vegetation control by hand.

Strike off and compact minor concrete with a mechanical or vibratory screed device. Apply a broom finish. Match the finished grade to the adjacent section of vegetation control, pavement, shoulder, or existing grade.

If the curing compound method is used for colored concrete, use curing compound no. 6.

83-1.02B(1)(d) Payment

Not Used

Replace item 1 in the 7th paragraph of section 83-1.02B with:

1. Wood 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-W-MGS for wood posts 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, UT84062, telephone (801) 785–0505 or from the distributor, Gregory Highway Products, 4100 13th Street, S.W., Canton, OH44708, telephone (330) 477–4800.
2. TYPE X-LITE - Type X-Lite terminal system must be a 31"X-Lite Guard Rail End Terminal as manufactured by Barrier Systems, Inc., located in Vacaville, CA, and must include items detailed for Type 31" X-Lite terminal system shown on the plans. The 31" X-Lite Guard Rail End Terminal can be obtained from the distributor, Statewide Safety and Signs, Inc., 130 Grobric Court, Fairfield, CA 94533, telephone (800) 770–2644.
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 Grobric 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 SKT-W-MGS terminal system, install the soil tube with soil plate attached at Post 1, breakaway cable terminal post at Post 2, and controlled release terminal posts at Posts 3 through 8. The soil tube must be, at the Contractor's option, driven with or without pilot holes, or placed in a drilled hole. Space around the steel foundation tube 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. A wood post must be inserted into the steel foundation tube by hand. Before the wood terminal post is inserted, the inside surfaces of the steel foundation tube to receive the wood post must be coated with a grease that will not melt or run at a temperature of 149 degrees F or less. The edge of the wood post may be slightly rounded to facilitate insertion of the post into the steel foundation tube.

For Type 31" X-Lite terminal system, all crimped posts and line posts must be W6 x 8.5 or W6 x 9 steel posts. All posts, must be, at the Contractor's option, either driven or placed in drilled holes. Space around the crimped posts, Post 2 with attached soil plate and lines 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. All blocks must be wood or plastic.

For Type 31" X-Tension terminal system, the steel post and soil anchor must be, at the Contractor’s option, driven with or without pilot holes, or placed in drilled holes. Space around the steel post 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. The wood terminal posts must be inserted into the drilled holes by hand and backfilled in the same manner as the steel post and soil anchor. Wood terminal posts must not be driven. All blocks must be wood or 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-SP-MGS for steel or FLEAT-W-MGS for wood 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, UT84062, telephone (801) 785–0505 or from the distributor, Gregory Industries, Inc., 4100 13th Street, S.W., Canton, OH44708, 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 Grobric 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-W-MGS terminal system, install the soil tubes with soil plate attached at Posts 1 and 2, breakaway cable terminal posts at Posts 1 and 2, and controlled release terminal posts at Posts 3 through 6. The soil tubes with soil plates 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. The breakaway cable terminal posts must be inserted into the steel foundation tubes by hand and must not be driven.

For Type 31" X-Tension terminal system, the steel post and soil anchor must be, at the Contractor’s option, driven with or without pilot holes, or placed in drilled holes. Space around the steel post 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. The wood terminal posts must be inserted into the drilled holes by hand and backfilled in the same manner as the steel post and soil anchor. Wood terminal posts must not be driven. All blocks must be wood or plastic.

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

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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. 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 existing traffic management system elements during construction

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.

The first order of work must be to complete:

1. Changeable Message Sign System (CMS) Location 1
2. Changeable Message Sign System (CMS) Location 2

Add to section 86-2.03B:

Use sleeve nuts on Type 1-A standards. The bottom of the base plate must be flush with finished grade.

Add to section 86-2.05A:

Conduit installed underground must be Type 3 Schedule 80.

Add to section 86-2.05B:

The conduit in a foundation and between a foundation and the nearest pull box must be Type 3 Schedule 80.

After conductors have been installed, the ends of the conduits terminating in pull boxes, service equipment enclosures, and controller cabinets 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 end of Section 86-2.05C:

Install conduit or inner duct by the directional boring method with the approval of the Engineer as shown or as specified in these special provisions.

Notify the Engineer 2 working days before starting directional boring operations.

Include the location and the equipment to be used in the advance notice to the Engineer.

Perform directional boring operations in the presence of the Engineer unless otherwise notified by the Engineer.

Conduit or inner duct installed by the directional bore method must comply with section 86-2.05A.

Install conduit to a minimum depth of3 ft below finished grade.

The diameter of the boring tool must be 1.5 times the outside diameter of the conduit. Use only mineral slurry or wetting solution to lubricate the boring tool and to stabilize the soil surrounding the boring path. Mineral slurry or wetting solution must be water based and environmentally safe.

Comply with Section 86-5.01A(4) for disposing residue from directional boring operations.

The directional boring equipment must have directional control of the boring tool and must have an electronic tool location detection system. During operation, the directional bore equipment must be able to determine the location of the tool both horizontally and vertically.

The directional boring equipment must be equipped with a tension measuring device that indicates the amount of tension exerted on conduit during conduit pulling operations.

Provide a layout and a profile plot to the Engineer showing the location of the bore to a resolution of 6 inches.

You must have direct charge and control of the directional bore operation at all times.

Do not use slurry cement backfill where the directional boring method is used.

Reform schedule 40 conduit with a mandrel after installation.

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:

District 8 - Caltrans Electrical Maintenance Yard
175 West Cluster Street
San Bernardino, CA 92408

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.

Cover the pull box with a plastic sheet and then bury it in soil from 6 to 8 inches below grade.

Plastic sheets must be 20 mil thick and made of HDPE or PVC virgin compounds.

Add to the RSS section 86-2.06:

86-2.06D Tamper Resistant Cover for Pull Box

86-2.06D(1) General

86-2.06D(1)(a) Summary

Section 86-2.06D includes specification for installing tamper resistant (TR) cover on non-traffic pull box.

86-2.06D(1)(b) Definitions

Fastening hardware: Bolts with necessary nuts and washers, fasteners, hex or lock nuts, or other metal components to lock the TR cover.

86-2.06D(1)(c) Submittals

Submit a list of materials, contract number, manufacturer's name, and manufacturer's instructions for installation before shipping TR cover and accessories to the job site.

Submit warranty documentation before installation.

86-2.06D(1)(d) Quality Assurance

Furnish a 2 year replacement warranty from the manufacturer for the TR cover and accessories against any defects or structural failures. The effective date of the warranty is the date of contract acceptance. Replacement parts must arrive within 5 business days after receipt of the failed parts. The Department does not pay for replacement parts. Deliver replacement parts to the Department's Maintenance Electrical Shop at:

District 8 - Caltrans Electrical Maintenance Yard
175 West Cluster Street
San Bernardino, CA 92408

Miscellaneous iron and steel materials under section 75-1.02.

Galvanized metal parts under section 75-1.05.

86-2.06D(2) Materials

Provide pull box cover and accessories. TR cover marking must comply with 86-2.06B.

The cover must be of 1/2 inch thick steel embossed with non-skid pattern.

Non-welded stainless steel fastening hardware must be passivated stainless steel type 304, 304L, 305, 316, 316L, or UNS Designation S30430. Welded stainless steel fastening hardware must be passivated stainless steel type 304L or 316L with 308L filler metal for 304L and 316L filler metal for 316L.

Provide the following:

1. A cover welded in factory, all around to security skirt sized to encase the pull box. The security skirt must be of steel.
2. L shape steel anchor rod not less than 1 inch diameter by 4 feet long for the No. 5 pull box, 1 inch diameter by 5 feet long for No. 6 pull box.
3. Top cap of stainless steel, steel hex nuts and lock nuts.
4. Epoxy to fill the lock nut socket space.
5. Steel plate 8 inch (Long) X 3 inch (Wide) X 3/16 inch (Thick).

TR cover and accessories must be manufactured by one of the following companies or equal:

1. Factory Direct Fastening, Inc 5655 Cahuenga Blvd, North Hollywood, CA 91601. Telephone (800) 942-4844.
2. ERC, Inc, 2970 E Maria, Rancho Dominguez, CA 90221. Telephone (310) 941-9390.
3. Pendarvis Manufacturing, 1808 American St., Anaheim, CA 92801. Telephone (714) 992-0950.

TR cover manufactured by Factory Direct Fastening, Inc is patented and royalty payments may apply.

Epoxy must conform to Loc-tite no. E-120HP or Scotch-weld no. DP460 or Devcon Plus 25 no.14278 or equal.

86-2.06D(3) Construction

Ground and bond TR cover.

Top of TR cover must be flush with finished grade.

Add 5 Amp fuse to lighting circuit conductors in the lighting standard handhole.

86-2.06D(4) Payment

Not Used.

Add to section 86-2.06:

86-2.06E Electronic Markers

86-2.06E(1) General

86-2.06E(1)(a) Summary

Section 86-2.06E includes specifications for providing Electronic Markers (EM) and Electronic Marker Locator (EML).

86-2.06E(1)(b) Submittals

Submit a copy of the training material for approval 15 days before the training. The training must include instruction on installing and locating the EM.

Submit a Certificate of Compliance for the EM.

Submit warranty documentation before installation.

86-2.06E(1)(c) Quality Control and Assurance

Furnish a 15-year replacement warranty from the manufacturer of the EM against any defects or failures. The effective date of the warranty is the date of installation. Replacement of EM must be furnished within 5 days after receipt of the failed parts. The Department does not pay for the replacement parts. Replacement EM must be delivered to the following department maintenance electrical shop:

District 8 - Caltrans Electrical Maintenance Yard
175 West Cluster Street
San Bernardino, CA 92408

86-2.06E(2) Materials

86-2.06E(2)(a) General

Not used

86-2.06E(2)(b) Electronic Marker

The EM must be of material that could be placed in the underground facility. It must produce a uniform radio frequency to assist in locating the facility when using compatible Electronic Marker Locator (EML).

The circuits of the EM, when excited by the compatible EML operating at standard industry frequencies, produces a uniform radio frequency (RF) field in all directions. The RF signal is picked up by the EML for precise location of the EM. Maximum signal strength must appear when the EML is vertically above the EM.

The field and the range of the EM must be reliable for use in any terrain.

The EM must not require any particular orientation when buried and there must not be any need for the EM to be leveled in the ground. The internal component must be capable of self-leveling and automatic orientation to a position providing maximum signal strength to the EML. The EM must be of the kind that it is just tossed in the trench or excavation and covered up with normal backfill.

The EM must be passive, and require no external or internal source of power. It must be energized solely by electromagnetic energy received from the interrogating EML.

The EM must comply with the following features:

Operational parameter	Requirements
Shape	Spherical or geometrical shape
Weight	2 lbs (Maximum)
Diameter	6 inch (Maximum)
Color	Red for power and orange for communication
Frequency	Standard frequencies, compatible with EML devices
Range	Easily locatable up to five feet between EML and the EM
Detection offset	6 inches (Maximum)

The EM must conform to the following:

1. Housing should be leak tight, moisture resistant, pressure tested per industry standards applicable to buried enclosures, buried splices, and buried cables
2. Housing Material should be chemical resistant like high density polyethylene with no hazardous chemicals
3. Operating Temperature: -4 to +122 degrees F.
4. Storage Temperature: -4 to +158 degrees F.

86-2.06E(2)(c) Electronic Marker Locator

EML must locate EM in existing buried pull boxes.

The EML must pick up radio frequency signal of the EM for precise location. Maximum signal strength must appear when the EML is vertically above the EM. The field and the range of the EML must be reliable for use in any terrain. The EML must detect buried EMs in the presence of barrier railings, guardrails and other obstacles.

The EML must be capable of locating buried EM placed in:

1. Pull boxes.
2. Cable paths.
3. Fiber optic facilities.
4. Snow covered installations.

The EML must be built to operate in all weather conditions and have the following features:

1. Detection offset must not be more than 6 inches from the point showing maximum RF field strength vertically above the EM.
2. Detect the EM within at least 5 foot range under normal conditions.
3. User-adjustable 'Detection Threshold'
4. Battery level indicator.
5. Large character display easy to read.
6. Bar graph, numeric and audible signal strength indicators.
7. Speaker volume adjustment.
8. Headphone jack.
9. Suitable for rugged construction.

The EML must comply with industry standards to quickly locate all brands of already buried EMs in underground power or communication facilities. The EML must be with no hazardous chemicals.

86-2.06E(3) Construction

You may use new or used EML suitable for the work needed. You will keep EMLs used for the project.

86-2.06E(4) Payment

Not used.

Add to section 86-2.08A:

Secure conductors and cables to the projecting end of the conduit in pull boxes.

86-2.08F Aluminum Conductors

Conductors No. 8 to No. 2 must be aluminum conductors that comply with ASTM B-800 and 801, excluding bonding jumpers and equipment grounding conductors.

Conductors, connectors, and terminals must be UL or NRTL listed and rated for 600 V(ac) operation.

Connectors must be rated for aluminum conductor connections and compression butt type. Where connectors are required for aluminum conductor connections with existing copper conductors, connectors must be rated for aluminum-copper conductor connections and must be compression butt type.

Connectors must be prefilled with oxide inhibiting compounds.

Fused splice connectors must be rated for aluminum and for aluminum-copper conductor connections, and prefilled with oxide inhibiting compounds.

Insulation for No. 8 to No. 2 aluminum conductors must be Type USE, RHH, or RHW cross-linked polyethylene. The insulation thickness must be 60 mils minimum.

Terminals must be rated for aluminum conductor connections and where required for aluminum-copper conductor connections and must be crimp type.

Use manufacturer recommended tools for crimping compression butt type connectors and terminals.

Solder aluminum conductors by hot iron, pouring, or dipping method if needed. Do not perform open-flame soldering.

Insulate the splices by "Method B".

Add to section 86-2.08:

86-2.08G Category 5E Cables

86-2.08G(1) General

86-2.08G(1)(a) Summary

Section 86-2.08G includes specifications for installing category 5E cables.

86-2.08G(2) Materials

Category 5E cables must be the unshielded, outdoor rated, non-gel filled type, and must meet the requirements of ANSI/TIA/EIA 568-B, category 5E cable.

Category 5E cables 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(ac) and 140 degrees 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 and voltage rating.
3. The finished outside diameter of the cable must not exceed 1/2-inch.

86-2.08G(3) Construction

The cable run between components must be continuous without splices. Provide a minimum of 3 feet of slack at each pull box and vault, and a minimum of 9 feet slack at the cabinet.

Arrange for a manufacturer representative to oversee the category 5E cable installation.

Limit installation length of the category 5E cable to less than 328 feet of finished cable for 10/100/1000 Base-T links. When Ethernet Extenders are used, the installation length must be compliant with specifications listed under Ethernet Extender.

86-2.08G(4) Payment

Not Used.

Replace the 1st paragraph of section 86-2.09E with:

Splices must be insulated by "Method B."

Delete the 6th and 7th paragraphs of section 86-2.09E.

Add to section 86-2.11A:

Circuit breakers must be the plug-in type mounted on non-energized clips. All circuit breakers must be mounted vertically with the up position of the handle being the "ON" position.

Circuits with Model 500 changeable message signs must have service equipment enclosures that have main busses and terminal lugs rated for 100 A, minimum, and a no. 2 bare copper ground wire.

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 section 86-2.18 with:

86-2.18 NUMBERING ELECTRICAL EQUIPMENT

The placement of numbers on electrical equipment will be done by others.

Add to section 86-6.10D:

86-2.19 IP PTZ CAMERA

86-2.19A General

Section 86-2.19 includes specifications for furnishing and installing the IP Pan/Tilt/ Zoom (PTZ) Camera.

86-2.19A(1) Glossary

CLI:A Command-Line Interface is a means of interaction with a computer program where the user issues commands to a program in the form of successive lines of text.

DHCP: The Dynamic Host Configuration Protocol is a network protocol to configure network devices so that they can communicate on an IPnetwork.

DNS: Domain Name System/Server is an Internet service that translates domain names into IP addresses.

PoE+ / **HPOE:** Power Over Ethernet IEEE 802.3at-2009 standard provides power on a standard Category 5 cable. Other POE variants are acceptable if compatible with IP PTZ Camera selected.

IEC: International Electro-technical Commission

IP: Internet Protocol, a communications protocol for computers connected to a network specifying the format for addresses and units of transmitted data.

NEMA: National Electrical Manufacturers Association standards

ONVIF: A global and open industry forum with goal to create a standard for how IP products within video surveillance and other physical security areas can communicate with each other.

ONVIF Profile S: A collection of specifications that guarantee the interoperability of IP video systems, such as video streaming and PTZ controls**.**

PTZ: Pan/Tilt/Zoom are functions of the IP PTZ Camera.

SD: Secure Digital memory card format.

SNMP: Simple Network Management Protocol is an Internet-standard protocol for managing devices on IP networks.

TIA/EIA: Telecommunications Industry Association / Electronic Industries Alliance. The standards address commercial building cabling for telecommunications products and services.

86-2.19A(2) Submittals

A minimum of 10 working days before the scheduled delivery of the IP PTZ Camera assembly to the project site, submit the following to the Engineer:

1. A certificate of compliance certifying that the IP PTZ Camera assembly complies with the requirements of the Special Provisions. The certificate must include a copy of all applicable test reports on the IP PTZ camera assembly.
2. Manufacturer's data sheets of the IP PTZ Camera cable assemblies, including connectors with strain relief back shells.

86-2.19A(3) Warranty

Furnish a 3 year replacement warranty from the manufacturer against any defects in materials or workmanship. The effective date of the warranty is the date of contract acceptance. Replacement parts must arrive within 10 business days after receipt of the failed parts. The Department does not pay for replacement parts. Deliver replacement parts to:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

86-2.19A(4) Quality Control and Assurance

86-2.19A(4)(a) Pre-Acceptance Testing

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 IP PTZ Camera system. Provide the necessary equipment required to access the IP PTZ Camera 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 IP PTZ Camera system.

86-2.19A(4)(b) Testing

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. Test and certify the Camera Ethernet cable to be compliant with TIA/EIA-568A standard for Category 5 cable.
2. Perform a local functional test at the IP PTZ Camera location.
3. Verify all the IP PTZ Camera features.
4. You must provide all test equipment.

Each IP PTZ Camera location must be subjected to post-installation tests as outlined herein. All software must be provided and installed before the start of testing. You must provide all necessary equipment required to access the IP PTZ Camera equipment for testing. This testing must be completed at:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

86-2.19B Materials

86-2.19B(1) General

The IP PTZ Camera must not exceed 11 inches (wide) by 17 inches (high) by 14 inches (deep). Any external cables must not interfere with or limit the continuous pan and tilt operation. The weight must not exceed 20 pounds.

The IP PTZ Camera must have all necessary wiring, cables, and connectors and must be plug-compatible, interchangeable and suitable for use with the IP PTZ Camera cable described elsewhere.

All cameras must meet the following requirements:

Parameter	Specification
Image Sensor	Progressive Scan CCD or CMOS
Minimum Image Resolution	1280 x 720 (HDTV 720p)
Gain Control	Automatic
Wide Dynamic Range Functionality	Required
Day/Night Operation	Adjustable (Auto, Color and Mono Modes)
Maximum Lens Aperture	f/1.6 (wide) to f/4.7 (tele)
Minimum Optical Zoom Range	30X, 4.3 mm to 129 mm with10XDigitalzoom
Optical Motorized Zoom Speed	Two speeds, from approximately 3.5 to 5 seconds full range
Horizontal Angle of View (Optical)	Approximately 59° to 1.7°;
Minimum Focus Distance	48”
Auto Focus	Selectable Auto/Manual.
Auto Shutter	Shutter speeds must be 1/4; to1/10,000second or better.
Auto Iris	Auto Iris: Iris must automatically adjust to compensate for changes in scene illumination to maintain constant video level output within sensitivity specifications
Sensitivity	Scene Illumination a. 0.5 lux @ 1/30 shutter,30 IRE, color mode b. 0.04 lux) @ 1/30 shutter,30 IRE, mono mode
Automatic White Balance	Required
Image Stabilization	Required
Power consumption	<70 with heater Watts
Camera/receiver/P&T driver (pan and tilt in motion) power	<40 Watts
Camera Operating Voltage	POE ++ or HPOE (based on camera requirements Typically 24V a/c)
Power Over Ethernet (POE) Injector Voltage	89 to 135 VAC, +/- 3 HZ Comply with NEMA-TS2, Para 2.1.2 and 2.1.3
Digital Video Output Connector	EIA/TIA RJ45
Operating Temperature	From 32 to 120 ºF
Operating Humidity	From 20 to 80 percent non-condensing

86-2.19B(2) Maintenance Requirements

Maintenance Requirements
1. Support Querying of Camera Parameters via Ethernet Connection
2. Remote software uploads and updates via Ethernet Connection
3. Camera System Auto Re-connect
4. Camera System reset via Ethernet Connection
5. Save and Restore Camera System Start-Up Configuration via Ethernet Connection
6. Camera Parameters: Serial Number, Software Revision, Camera Model Number and Configuration Settings

86-2.19B(3) IP Management

IP Management Requirements
1. IP Configuration: DHCP or Static IP Address Entry
2. Net Mask Address Entry
3. Gateway Address Entry
4. Domain Name Entry
5. DNS server entry
6. Multicast Address Entry

Programming must be stored non-volatile memory and the IP PTZ Camera assembly firmware must be updateable via Ethernet communication.

86-2.19B(4) Environmental Enclosure

The environmental enclosure must be a sealed type, designed to withstand exposure to sand, dust, fungus, rain, and house the assembled camera, motorized zoom lens and all internal wiring.

The enclosure, at a minimum, must be IP66 rated in accordance with the IEC 605292 standard for outdoor surveillance, and be IK7 rated in accordance with the IEC 62262 standard to resist vandalism.

The enclosure must include an internal thermostatically controlled heater assembly to minimize external faceplate condensation.

The pan and tilt function must be designed to operate under a full range of environmental conditions and must withstand a wind load of 75 mph.

86-2.19B(5) Protocols

The IP PTZ Camera's protocols must include integrated video camera system communication drivers for flexibility and system interoperability.

86-2.19B(6) Operational Requirements

Operational Parameters
1. Support Cohu, Javelin, Pelco or Onvif (Profile S) Protocols
2. Support Commands for Continuous PTZ movement
3. Camera Position Information (Tilt Angles, Pan Positions, Zoom Levels) obtainable via Camera Protocol by User
4. TCP/IP 100 Base T Fast Ethernet Data Communication Port or better

86-2.19B(7) Functional Requirements

Functional capabilities must meet the following requirements:

1. The IP PTZ camera must incorporate a built-in Web Server:
    a. The following web browsers can be used to access and configure the camera: Internet Explorer version 10.0, Firefox version 19.02, Safari version 5.1 and Chrome version 25.0. They can also be used without the need for special viewing software.
    b. The camera must be capable of generating HTML code for the video image, allowing for easy web page integration.
2. The IP PTZ camera must support the following network protocols:
    IPv4, IPv6, TCP, UDP, ARP, ICMP, IGMP, HTTP, HTTPS, FTP (client only), SSL, SMTP, DHCP, DNS, NTP, RTP/RTCP, RTSP over TCP, RTSP over HTTP, and SNMP (v2c, v3).
3. Network security must be via password (basic authentication).
4. The camera must support time synchronization via NTP server.
5. The camera must support automatic adjustment of daylight savings time.

6. The camera must have the capability to display a wide variety of overlays in any of 6 positions on the video image
    a. The following overlays must be possible:
        i. Camera ID
        ii. Graphic logo
        iii. Date/Time data
        iv. Azimuth: Displayed the current direction by defining 4 directions: N (North), E (East), S (South), and W (West)
7. The camera pan tilt function must be capable of 360˚ pan rotation and a minimum tilt range of 180˚
8. The pan and tilt functions must be capable of variable speeds, adjusting automatically for different zoom levels.
9. The camera must include programmable privacy zones. The settings of these zones will be determined by the Engineer.
10. Camera must provide a presets for azimuth, elevation and lens position (Minimum of 24 Presets)
11. Camera video streaming:
    a. The camera must have the capability to stream H.264 video in TCP protocol and H.264 video in UDP (Unicast/Multicast) protocol.
    b. The camera must support streaming Mode: CBR or VBR
    c. The camera must stream 3 independently configured video streams.
    d. Minimum Configuration: 1 H.264 720p 30fps + 1 H.264 CIF 30fps + 1 MJPEG 720p 5fps
    e. Must support at least 5 simultaneous output streams.
12. The manufacturer must provide a Software Development Kit (SDK), allowing any 3rd party developers the necessary tools for integrating of the camera system into the users control system environment.
13. The camera must have configurable time zones to offset from UTC time.

86-2.19B(8) Cable Requirements

Camera Cable Requirements
CAT 5E Outdoor Rated Cable
Contain a Strain Relief
Include a Cable Support Grip to be hung from the “J” Hook

86-2.19C Construction

The installation of the IP PTZ camera must be according to the plans and the manufacturer's instructions.

Camera cable must not be spliced.

Install cables without damaging the conductors, insulation or jacket. Do not bend cables tighter than the manufacturer's recommended bending radius.

Provide a minimum of 3 feet of cable slack for equipment movement at pull boxes, vaults or cabinets. The cable must be secured and coiled neatly.

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.

Grounding of the IP PTZ camera must be per the manufacturer’s instructions.

86-2.19D Payment

Not Used

Add section 86-2.20 with:

86-2.20 FIBER OPTIC COMMUNICATION SYSTEM

86-2.20A GENERAL

86-2.20A(1) Summary

Section 86-2.20 includes specifications for installing a fiber optic communication system. The fiber optic system must include fiber optic conduit, innerduct, fiber optic cable, fiber optic splice vaults, and auxiliary equipment as shown and as specified in the special provisions. Comply with Section 86 of the Standard Specifications.

86-2.20A(2) Definitions

Active Component Link Loss Budget: The active component link loss budget is the difference between the average transmitter launch power (in dBm) and the receiver maximum sensitivity (in dBm).

Backbone: Fiber cable that provides connections between the TMC and hubs, as well as between equipment rooms or buildings, and between hubs. The term is used interchangeably with "trunk" cable.

Breakout: The cable "breakout" is produced by (1) removing the jacket just beyond the last tie-wrap point, (2) exposing 900 to 1800 mm of the cable buffers, aramid strength yarn and central fiberglass strength member, and (3) cutting 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.

Connector Module Housing (CMH): A patch panel used in the FDU to terminate singlemode fibers with most common connector types. It may include a jumper storage shelf and a hinged door.

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 FDUs, mounted in panels. They may also be used unmounted, to join two simplex fiber runs.

Distribution Cable: Fiber cable that provides connections between hubs. Drop cables are typically spliced into a distribution cable.

Drop Cable: Fiber cable that provides connections between a distribution cable to a field element. Typically these run from a splice vault to a splice tray within a field cabinet. Drop cables are usually short in length (less than 65 feet) and are of the same construction as outside plant cable. The term “breakout cable” is used interchangeably with drop cable.

End-to-End Loss: The maximum permissible end-to-end system attenuation is the total loss in a given link. This loss could be the actual measured loss, or calculated using typical (or specified) values. A designer should use typical values to calculate the end-to-end loss for a proposed link. This number will determine the amount of optical power (in dB) needed to meet the System Performance Margin.

Fan Out Termination: Permits the branching of fibers contained in an optical cable into individual cables and can be done at field locations; thus, allowing the cables to be connectorized or terminated per system specifications. A kit provides pull-out protection for individual bare fibers to support termination. It provides three layers of protection consisting of a Teflon inner tube, a dielectric strength member, and an outer protective PVC jacket. Fan out terminations must not be used for more than 6 fibers. For more than 6 fibers, using fan out termination in conjunction with patch panel would be appropriate.

Fiber Distribution Frame (FDF): A rack mounted system that consists of a standard equipment rack, fiber routing guides, horizontal jumper troughs and Fiber Distribution Units (FDU). The FDF serves as the termination and interconnection of 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 splice tray(s). The unit's patch panel and splice trays may be integrated or separated by a partition.

FBC: Fiber Backbone Cable.

FO: Fiber optic.

FOIP: Fiber optic inside plant cable.

FOOP: Fiber optic outside plant cable.

FOTP: Fiber optic test procedure(s) as defined by TIA/EIA standards.

Interconnect and Termination Unit (ITU): An enclosure that provides interconnect capability of one multi-fiber cable to a minimum of 12 single-fiber cable.

Jumper: A short fiber optic cable, typically one meter or less, with connectors on each end, 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 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 connectorized. A link may include splices and couplers. For example, a video datalinkfrom a FO transmitter to a video FO receiver or to a FO 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 buffer tubes to isolate them from outside forces (stress). A flooding compound or material is applied to the interstitial cable core to prevent water migration and penetration. This type of cable is primarily for outdoor applications.

Mid-span Access Method: Description of a procedure in which fibers from a single buffer tube are accessed and spliced to an adjoining cable without cutting the unused fibers in the buffer tube, or disturbing the remaining buffer tubes in the cable.

MMFO: Multimode Fiber Optic Cable.

OFNR: Optic Fiber Non-conductive Riser.

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 in a FO cable between two points and over the corresponding distance. It provides a visual and printed display of the losses or defects associated with each system component such as fiber sections, splices, and connectors.

Optical Attenuator: An optical element that reduces the intensity of a signal passing through it.

Patchcord: A term used interchangeably with "jumper".

Patch Panel: A precision drilled metal frame containing couplers used to mate two fiber optic connectors.

Pigtail: A short length of fiber optical cable permanently connectorized at 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, when coupled 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 optical power being received at the 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.

SMFO: Singlemode Fiber Optic Cable.

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. 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.

System Performance Margin: A calculation of the overall "End to End" permissible attenuation from the fiber optic transmitter (source) to the fiber optic receiver (detector). The system performance margin should be at least 6 dB. This includes the difference between the active component link loss budget, the passive cable attenuation (total fiber loss) and the total connector/splice loss.

Tight Buffer Cable: 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). The tight buffer cable must meet all the characteristics of the fiber in the fiber optic outside plant cable specified in these specifications.

86-2.20A(3) Submittals

Documentation of all test results must be provided to the Engineer within 2 working days after the test involved.

86-2.20A(4) Warranty

Furnish a 3 year replacement warranty from the manufacturer against any defects in materials or workmanship. The effective date of the warranty is the date of contract acceptance. Replacement parts must arrive within 10 business days after receipt of the failed parts. The Department does not pay for replacement parts. Deliver replacement parts to:

District 8 - Caltrans Electrical Maintenance Yard
175 West Cluster Street
San Bernardino, CA 92408

86-2.20A(5) Quality Control and Assurance

86-2.20A(5)(a) Fiber Optic Testing

Testing must include the tests on elements of the passive fiber optic components: (1) at the factory, (2) after installation but prior to connection to any other portion of the system and (4) during final system testing. The active components must be tested after installation. You must provide all personnel, equipment, instrumentation and materials necessary to perform all testing. You must 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.

Documentation of all test results must be provided to the Engineer within 2 working days after the test involved.

A minimum of 10 working days prior to arrival of the cable at the site, you must provide details for all field testing for the Engineer's review and approval. The details must include the tests involved and the procedure to conduct the tests. The following items must be included in the test details the model, manufacturer, configuration, calibration and alignment and operating procedures for all proposed test equipment.

For each of the required tests, you must submit two hard copy printouts and two electronic copies of traces on ISO 9660 Recordable Compact discs, test results and trace analysis software to the Engineer. The analysis software must be able to compare files, print traces and operate in a Microsoft Windows environment approved by the Engineer.

86-2.20A(5)(b) Factory Testing

You must provide the documentation from the original manufacturer pertaining to factory testing and compliance with the fiber specifications as listed in the Fiber Characteristics Table in these special provisions. 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 test results must be (1) maintained on file by the manufacturer with a file identification number for a period of minimum seven years, (2) attached to the cable reel in a waterproof pouch, and (3) provided to the Engineer.

Copies of the test results must also be filed with the test documents accompanying the shipping reel in a separate weather proof envelope.

86-2.20A(5)(c) Arrival On Job Site

86-2.20A(5)(d) After Cable Installation

Index matching gel must not be allowed in connectors during testing. After the fiber optic cable has been pulled but before breakout and termination, 100 percent of all the fibers must be tested with an OTDR for attenuation. OTDR must be capable of recording and displaying anomalies of 0.02 dB as a minimum. Test results must be recorded, dated, compared and filed with the previous copies of these tests. You must submit copies of traces and test results to the Engineer. If the OTDR test results are unsatisfactory, the FO cable segment of cable must be unacceptable. The unsatisfactory segment of cable must be replaced with a new segment, without additional splices, at your expense. The new segment of cable then must be tested to demonstrate acceptability. You must submit copies of the test results to the Engineer for approval.

86-2.20A(6) System Cable Verification At Completion

86-2.20A(6)(a) OTDR Testing

Once the passive cabling system has been installed and is ready for activation, 100 percent of the fibers must be tested with the OTDR for attenuation at wavelengths of both 1310 nm and 1550 nm. Individual fusion splice losses must not exceed 0.07 dB. OTDR testing must be performed in both directions (bidirectional), on all fibers. Test results must be generated from software of the test equipment, recorded, dated, compared and filed with previous copies. The average of the two losses must be calculated, and recorded in the Cable Verification Worksheet in Appendix A. The OTDR must be capable of recording and displaying anomalies of at least 0.02 dB. All connector losses must be displayed on the OTDR traces. The OTDR test results must include the GPS coordinates of the source and destination test points. The mapping grade GPS equipment used must be accurate to six decimal places for both latitudes and longitudes. You must provide a spreadsheet in Microsoft Excel compatible format documenting the OTDR test results. You must provide test results by submitting two hard copy printouts and two electronic copies of traces on ISO 9660 Recordable Compact discs.

86-2.20A(6)(b) Power Meter and Light Source

At the conclusion of the OTDR testing, 100 percent of the fiber links must be tested end to end with a power meter and light source, in accordance with EIA Optical Test Procedure 171 and in the same wavelengths specified for the OTDR tests. These tests must be conducted in one direction. As shown in Appendix A, the Insertion Loss (1C) must be calculated. Test results must be recorded, compared, and filed with the other recordings of the same links. Test results must be submitted to the Engineer. These values must be recorded in the Cable Verification Worksheet in Appendix A.

86-2.20A(6)(c) Cable Verification Worksheet

The Cable Verification Worksheet shown in Appendix A must be completed for all links in the fiber optic system, using the data gathered during cable verification. The completed worksheets must be included as part of the system documentation.

86-2.20A(6)(d) 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. The unsatisfactory segments of cable, or splices must be replaced with a new segment of cable or splice at your expense. The OTDR testing, power meter and light source testing and Cable Verification Worksheet must be completed for the repaired link to determine acceptability. You must 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 and two connectors. The removal of a small section containing the failure and therefore introducing new unplanned splices will not be allowed.

86-2.20A(6)(e) Passive Component Package Testing and Documentation

In developing the passive component package, each connector termination (pigtail or jumper) must be tested for insertion attenuation loss using an optical power meter and source. In addition, all singlemode terminations must be tested for return reflection loss. The loss test results must comply with these special provisions and must be recorded on a tag attached to the pigtail or jumper.

Once an assembly is complete, the manufacturer must visually verify all tagging of loss values is complete. As a final quality control measure, the manufacturer must do an "end to end" optical power meter/light source test from pigtail end to end to the terminating point 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. You must provide a copy to the Engineer, and a copy must also be maintained on file by the manufacturer or supplier.

The assembled and completed FDU unit must then be protectively packaged for shipment to you for installation.

86-2.20A(7) Fiber Optic System Performance Margin Design Criteria

The installed system performance margin must be at least 6 dB for every link. If the design system performance margin is less than 6 dB, the Engineer must be notified and informed of your plan to meet that specification.

86-2.20A(7)(a) Active Component Testing

The transmitters and receivers must be tested with a power meter and light source, to record the transmitter average output power (dBm) and receiver sensitivity (dBm). These values must be recorded in the Fiber System Performance Margin Calculations Worksheet in Appendix B, section C, number 6 and submitted to the Engineer for approval.

APPENDIX A

Cable Verification Worksheet

End-to-End Attenuation (Power Meter and Light Source) Testing

and OTDR Testing

Contract No. _____ Contractor: _____

Operator: _____ Date: _____

Link Number: _____ Fiber Number: _____

Test Wavelength (Circle one): 1310 nm 1550 nm

Expected Location of fiber ends: End 1: _____ End 2: _____

Power Meter and Light Source Test Results:

Power In:	_____ dBm	1A
Output Power:	_____ dBm	1B
Insertion Loss [1A - 1B]:	_____ dB	1C

OTDR Test Results:

Forward Loss:	_____ dB	2A
Reverse Loss:	_____ dB	2B
Average Loss [(2A + 2B)/2]:	_____ dB	2C

To Be Completed by Caltrans:

Resident Engineer's Signature: _____

Cable Link Accepted: _____

APPENDIX B

Fiber System Performance Margin Calculations Worksheet

A. Calculate the Passive Cable Attenuation

1. Calculate Fiber Loss at Operating Wavelength: _____ nm	Cable Distance (times) Individual Fiber Loss (equal) @ 1310 nm (0.4 dB/km) @ 1550 nm (0.3 dB/km)	_____ km x ___ dB/km =
	Total Fiber Loss:	_____ dB

B. Calculate the Total Connector/Splice Loss

2. Calculate Connectors/couplers Loss: (exclude Tx and Rx connectors)	Individual Connector Loss (times) Number of Connector Pairs (equal) **Total Connector Loss:**	0.4 dB x ____ = _____ dB
3. Calculate Splice Loss:	Individual Splice Loss (times) Number of Splices (equal) **Total Splice Loss:**	0.07 dB x ____ = _____ dB
4. Calculate Other Components Loss:	**Total Components:**	_____ dB
5. Calculate Total Losses:	Total Connector Loss (plus) Total Splice Loss (plus) Total Components (equal)	+ dB + dB + dB =
	Total Connector/Splice Loss:	_____ dB

C. Calculate Active Component Link Loss Budget

System Wavelength: Fiber Type: Average Transmitter Output (Launch Power):		_____ nm singlemode _____ dBm
Receiver MAX Sensitivity (10^9 BER) (minus) Receiver MIN Sensitivity (equal) **Receiver DynamicRange:**		_____ dBm - _____ dBm = _____ dB
6. Calculate Active Component Link Loss Budget:	Average Transmitter Output (Launch Power) (minus) Receiver MAX Sensitivity (equal)	_____ dBm - _____ dBm =
	Active Component Link Loss Budget:	_____ dB

D. Verify Performance

7. Calculate System Performance Margin to Verify Adequate Power:	Active Component Link Loss Budget **[C]** (minus) Passive Cable Attenuation **[A]** (minus) Total Connector/Splice Lost **[B]** (equal)	_____ dB - _____ dB - _____ dB =
	System Performance Margin:	_____ dB

86-2.20A(8) Data Integration Testing

System testing and documentation covers the integration testing (data) which is required to validate the operational performance of the communication system.

86-2.20A(8)(a) System Documentation

Submit a draft copy of all documentation for review and approval before production of documentation. The Engineer will review and approve or reject the draft documentation within 2 weeks of receipt.

Deliver two copies of all final documents. The copies must be 8 ½" x 11" and bound in three-ring, hard-covered binders, complete with dividers.

Documentation must consist of the following types of manuals and drawings and must include the information described.

1. Configuration of Hardware and Software Documentation
   1.1. Provide proper documentation for all configurations of hardware and software.
2. Test Results
   2.1. The test result section of the operations and maintenance must include a copy of the results for all the tests that you have conducted.

You must test all material, equipment and cable after installation. These tests must comply with the "Performance Testing" sub-sections for each individual item where applicable.

You must supply all test equipment required.

Switches and routing equipment must be delivered to the TMC for configuration, a minimum of 2 weeks prior to installation in the field.
You must configure all other equipment prior to testing or installation in the field.
The following network information will be supplied:

1. IP addresses
2. Mask
3. Gateway
4. Replacement Administrative Password
5. SNMP Community Strings
6. Wireless Security Settings (when applicable)

You must submit an installation and test plan which details the method of installation and site testing for all material, equipment, and cable and the associated schedule of activities. Two copies of the installation and test plan must be submitted for approval, at least 2 weeks before proposed testing dates.

The equipment and hardware must be installed as shown and described. Tests and inspections must include:

1. Visual inspection for damaged or incorrect installation.
2. Measurement of parameters and operating conditions.

These tests must be performed in accordance with the approved installation and test plan.

You must notify the Engineer of your intent to proceed with installation and testing 48 hours before commencement of each test.

86-2.20A(8)(b) Physical Inspection

You must provide documentation to prove delivery of all material, equipment, cable and documentation. If any material or documentation is outstanding or have been replaced under pre-acceptance warranty a physical inspection and documentation must be provided for this material. The physical inspection must consist of inspecting all installed material to ensure that workmanship satisfies the specified requirements.

86-2.20A(8)(c) Data Link Testing

To verify all of the communication equipment is properly connected and responding to the assigned IP addresses, the acceptance testing for each device consists of the following steps:

A. From the Inland Empire Transportation Management Center (TMC), with the communication system functioning under normal conditions, each device must respond as follows:

B. The device must respond correctly to an Internet Control Message Protocol (ICMP) echo requests from the District TMC.

C. The device must be turned OFF. An ICMP echo request from the District TMC must then be sent and the device must not be responsive.

D. The device must then be turned ON. An ICMP echo request from the District TMC must be then be sent and the device must be responsive. At least five consecutive responses without packet loss are required to be considered a successful test.

Verify that each device responds and record the response time for each request.

The Inland Empire TMC is located at:

13892 Victoria Street
Fontana, CA 92336

86-2.20A(8)(d) Acceptance Testing

Acceptance testing includes the preparation of an acceptance test plan, conducting acceptance tests and subsequent retests, and documentation of the results.

Final acceptance tests must be conducted after the site test results have been reviewed and accepted. These tests include the complete system in normal operations.

The acceptance test plan must detail all tests to be performed, the test results which are expected and the test schedule. The acceptance test plan will include the following major tests and acceptance categories:

1. Successful acceptance of Subsystem testing
2. Performance tests after connecting the system.
3. Functional tests after connecting the system.

All acceptance test results must be fully documented and such documentation provided as a condition of acceptance.

86-2.20A(8)(e) Performance Tests

Performance tests must document the following:

1. Average TCP and UDP upstream and downstream Bandwidth.

2. Average UDP upstream and downstream percent of packet loss

3. Average round trip time (RTT) or latency

4. Standard Deviation or a graph of each test over the time of the test.

5. Location being tested with source IP address used in the test

You must conduct operational performance tests on the following:

1. From each field element endpoint to the 10G HFOS in Hub I
2. From each data node switch to the 10G HFOS in Hub I through a Gigabit interface
3. From each mini-hub switch (10G HFOS) to the 10G HFOS in Hub I through a 10 Gigabit interface

86-2.20A(8)(f) Final Acceptance

The system will not be accepted until all of the following conditions have been met as follows:

1. Physical, performance, and functional acceptance tests have been completed and the results are approved.
2. All documentation has been completed and submitted.
3. All connections that were changed to perform acceptance tests are restored and tested to form a fully operational system.

86-2.20B MATERIALS

86-2.20B(1) Fiber Optic Conduit

Fiber optic conduit must comply with UL 651A, unless otherwise specified. Fiber optic conduit must be orange Schedule 80 high density polyethylene (HDPE) conduit and comply with NEMA TC-7.

HDPE conduit must be joined by heat fusion (includes electrofusion) method recommended by the conduit manufacturer, and with the equipment approved for the purpose. Equipment must not expose conduit to direct flame. Heat fusion must be performed by conduit manufacturer certified or authorized personnel. A minimum of 2 test fusions, by each fusion operator, must be demonstrated to the Engineer prior to performing fusion operations on any HDPE conduit to be installed.

Fiber optic conduit in structures must be Type 1.

86-2.20B(2) Innerduct

Innerduct must be installed wherever fiber optic cable is installed, except for conduit that houses Type D fiber optic cable.

Copper cable must not be mixed with fiber optic cable within the same innerduct, except the tracer wire where specified.

Innerduct consists of an extruded flexible annealed polyethylene tubing that is installed inside conduit or buried directly as specified, and which in turn the fiber optic cable is installed. Innerduct within a conduit run must be continuous without splices or joints and must be continuous longitudinally ribbed inside and outside. Direct burial innerduct run must be continuous without splices or joints, and must be continuous longitudinally ribbed inside and smooth outside.

Unless otherwise shown on the plans, innerduct must be nominal 1inch inside diameter, with a minimum SDR rating of 11 and must meet the following requirements:

1. Polyethylene for innerduct must have a density of 59.6187 lb/ft3 ± 0.3121 lb/in3 (ASTM Designation: D 1505) and must conform to the applicable requirements of ASTM Designation: D 3485, D 3035, D 2239, and D 2447, and the applicable requirements of NEMA TC7 and TC2. Tensile yield strength must be 3300 psi minimum in accordance with the requirements in ASTM Designation: D 638.
2. Different innerducts within the same conduits must be different colors and the colors chosen must be consistent with the required cables throughout the project. See the table below:

Color	Fiber optic cable
Gray	Type F-(72 fiber)
Orange	Pull Rope

Pull tape for future use must be installed in those innderducts containing no fiber optic cable.

The innerduct must be shipped on reels marked with the manufacturer, the contract number, and the size and length of the innerduct. The product on reels must be covered with aluminized material to protect colors from UV deterioration during shipment and storage.

86-2.20B(2.5) Innerduct Coupler

The innerduct coupler must be designed to meet these parameters:

Description	Parameters
Innerduct size	1 inch
Duct OD working range	1.315-1.325 inch minimum
Minimum Tensile Pullout	600 lbs
Maximum Air Pressure	Minimum of 130 PSI
Sealing	Water and air tight
Duct compatibility	For use on HDPE innerduct
Application	Designed for use in direct burial applications

Innerduct coupler installation must follow the manufacturer's recommendations. You must provide all tools necessary for installation as recommended by the manufacturer.

86-2.20B(3) Warning Tape

Warning tape must be furnished, installed and placed in the trench over fiber optic conduit as shown on the plans.

The warning tape must have:

Description	Parameters
Thickness	Not Less Than 4 mil
Width	4 inch
Material	Pigmented Polyolefin Film
Tensile strength	Minimum of 2800 PSI
Elongation	Minimum of 500 Percent Elongation Before Breakage
Printed Text height	1 inch
Message Background Color	Bright Orange Color Background
Message Statement	CAUTION: BURIED FIBER OPTIC CABLE - CALTRANS
Message Spacing Intervals	Approximately 30 inch

The printed warning must not be removed by the normal handling and burial of the tape and must be rated to last the service life of the tape.

The construction of the warning tape must be such that it will not delaminate when it is wet. It must be resistant to insects, acid, alkaline and other corrosive elements in the soil.

Warning tape must be manufactured by Condux International, Inc.; Allen System, Inc.; Reef Industries, Inc. or equal.

86-2.20B(4) Tracer Wire

Tracer wire must be installed in fiber optic conduit or innerduct as shown on the plans.

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 of slack must be extended into each pull box and splice vault from each direction.

The tracer wire must form a mechanically and electrically continuous line throughout the length of the trench.

Tracer wire may be spliced at intervals of not less than 500 feet and in pull boxes. Splices must conform to Section 86-2.09, "Wiring," of the Standard Specifications.

86-2.20B(5) Fiber Optic Trench Delineator

Fiber optic trench delineators must conform to the provisions in Section 82, "Markers and Delineators," of the Standard Specifications and these special provisions.

Delineators on flexible posts must conform to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. Flexible posts must be made from a flexible white plastic which must be resistant to impact, ultraviolet light, ozone, and hydrocarbons. Flexible posts must resist stiffening with age and must be free of burns, discoloration, contamination, and other objectionable marks or defects which affect appearance or serviceability.

Non-reflective sheeting for flexible target plates must be the non-reflective sheeting designated for channelizers, markers, and delineators conforming to the requirements in ASTM Designation: D 4956-95 and in conformance with the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

The following information must be added to each post by an adhesive sticker which must be resistant to ultraviolet light, ozone, and hydrocarbons.

UNDERGROUND
FIBER OPTIC
CABLE
IN THIS AREA
W
A
R
N
I
N
G
BEFORE EXCAVATING OR
IN AN EMERGENCY
NOTIFY
CALTRANS, SAN BERNARDINO, CA

Flexible posts must be installed every 500 feet or at any point that the fiber optic conduit or innerduct changes direction. Posts must not be placed in front of pull boxes.

If fiber optic conduit or Innerduct is installed under a paved shoulder, the flexible posts must be installed in the dirt shoulder, immediately adjacent to the paved shoulder. The message on the post must indicate (in feet) the distance it is offset from the fiber optic conduit.

The flexible post may be installed by placing it into the trench prior to backfilling and compacting, or by placing it into a 18 inch steel anchor sleeve that is driven into the ground prior to installing the flexible post. The flexible post and anchor must have locking tabs that prevent removal of the flexible post from the anchor sleeve.

The top of the fiber optic trench delineator must be set at a height of 48 inches above ground level.

86-2.20B(6) Conduit Sealing Plugs

All fiber optic conduit must have their ends sealed with commercial pre formed plugs, which prevent the passage of gas, dust and water into these conduits. Sealing plugs must be installed at the ends of conduits terminating in splice vaults, communication pull boxes, and controller cabinets.

Sealing plugs must be removable and reusable. Plugs must be the split type that permits installation or removal without removing conductors or cables.

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 to the polyester tape.

Sealing plugs that seal between the 4 inch fiber optic conduit and innerducts must seal the conduit and all innerducts simultaneously with one self contained assembly having an adjustable resilient filler of polyurethane elastomer clamped between backing ends and compressed with stainless steel hardware. Sealing plugs must be capable of withstanding a pressure of 5 psi.

Sealing plugs that seal the innerducts must seal each innerduct individually with appropriate sizes and configuration to accommodate either empty ducts or those containing fiber optic cable. To provide suitable sealing between the varying size cables and the plugs, split polyurethane elastomer adapting sleeves, used singularly or in multiples, must be inserted within the body of the plugs.

86-2.20B(7) Fiber Optic Cable

Fiber optic cable must conform to the details shown on the plans and these special provisions.

Each fiber optic cable for this project must be all dielectric, water-blocking material, duct type, with loose buffer tubes and must conform to these special provisions. Cables with singlemode fibers must contain singlemode (SM) dual-window (1310 nm and 1550 nm) fibers. 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 and/or fiberglass must be used as a primary strength member, and a polyethylene outside jacket must provide for overall protection.

All fiber optic (FO) 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 Rural Utilities Service Chapter XVII, Title 7, Section 1755.900 (RUS Federal Rule 7CFR1755.900).

Cable Type	Description
D	12 SMFO
F	72 SMFO

86-2.20B(7)(a) Fiber Characteristics

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 occlusions to comply with the optical, mechanical, and environmental specifications. The required fiber grade 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 specifications over an operating temperature range of -40℃ to +70℃. 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 (-40℃ to +70℃) 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 comply with the specifications in the following table:

Fiber Characteristics Table	
Parameters	Singlemode
Type	Step Index
Core Diameter	8.3 µm (nominal)
Cladding Diameter	125 µm ±1.0 µm
Core to Cladding Offset	≤1.0 µm
Coating Diameter	250 µm ±15 µm
Cladding Non-circularity defined as: [1-(min. cladding dia ÷max. cladding dia.)]x100	≤2.0%
Proof/Tensile Test	345 Mpa, min.
Attenuation: (-40°C to +70°C) @1310 nm @1550 nm	 ≤0.4 dB/km ≤0.3 dB/km
Attenuation at the Water Peak	≤2.1 dB/km @ 1383 ±3 nm
Chromatic Dispersion: Zero Dispersion Wavelength Zero Dispersion Slope	 1301.5 to 1321.5 nm ≤0.092 ps/(nm^2*km)
Maximum Dispersion:	≤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 ±0.5 µm at 1300 nm 10.5 ±1.0 µm at 1550 nm

86-2.20B(7)(b) Color Coding

In buffer tubes containing multiple fibers, each fiber must be distinguishable from others in the same tube by means of color coding according to the following:

1. Blue (BL)	7. Red (RD)
2. Orange (OR)	8. Black (BK)
3. Green (GR)	9. Yellow (YL)
4. Brown (BR)	10. Violet (VL)
5. Slate (SL)	11. Rose (RS)
6. White (WT)	12. Aqua (AQ)

Buffer tubes containing fibers must also be color coded with distinct and recognizable colors according to the same table listed above for fibers.

These colors must be targeted in accordance with the Munsell color shades and must meet EIA/TIA-598 "Color Coding of Fiber Optic Cables."

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.

The fiber optic cable samples of 10 feet length with part numbers, original catalogue and documents from manufactures must be submitted to the Engineer.

86-2.20B(7)(c) Cable Construction

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

86-2.20B(7)(d) Buffer Tubes

Clearance must be provided in the loose buffer tubes 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. The fibers must not adhere to the inside of the buffer tube. Each buffer tube must contain a maximum of 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 filling must be with a water swellable yarn or a compound, which fills voids and swells to block the ingress of water, 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, such as the reverse oscillation stranding process, that will prevent stress on the fibers when the cable jacket is placed under strain.

86-2.20B(7)(e) 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 and to ensure proper spacing between buffer tubes during stranding.

86-2.20B(7)(f) Filler Rods

Filler rods may be included in the cable to maintain the symmetry of the cable cross-section. 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.

86-2.20B(7)(g) Stranding

Completed buffer tubes must be stranded around the over coated 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.

86-2.20B(7)(h) Core and Cable Flooding

The cable core interstices must contain a water blocking material, to prevent water ingress and migration. The water blocking material must be an absorbent polymer, which fills voids and swells to block the ingress of water. The flooding compound or material must be homogeneous, non-hygroscopic, electrically non-conductive, and non-nutritive to fungus. The compound or material must also be nontoxic, dermatologically safe and compatible with all other cable components.

86-2.20B(7)(i) Tensile Strength Member

Tensile strength must be provided by high tensile strength aramid yarns and/or fiberglass which must be helically stranded evenly around the cable core and must not adhere to other cable components.

86-2.20B(7)(j) Ripcord

The cable must contain at least one ripcord under the jacket for easy sheath removal.

86-2.20B(7)(k) 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 40.0mil ± 3 mil. Jacketing material must be applied directly over the tensile strength members and water blocking material 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 be marked with 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 100 ±10 mil.

86-2.20B(7)(l) General Cable Performance Specifications

The F/O cable must withstand water penetration when tested with a 3 feet static head or equivalent continuous pressure applied at one end of 3 feet length of filled cable for one hour. No water must leak through the open cable end. Testing must be done in accordance with 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 EIA/TIA-455-81A (FOTP-81A), "Compound Flow (Drip) Test for Filled Fiber Optic Cable". No preconditioning period must be conducted. The cable must exhibit no flow (drip or leak) at 70℃ as defined in the test method.

Crush resistance of the finished FO cables must be 220 N/mm 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 of 0.10 in to 0.75 in 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 must constitute 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. Impact testing must be conducted in accordance with TIA/EIA-455-25B (FOTP-25) "Impact Testing of Fiber Optic Cables and Cable Assemblies." The average increase in attenuation for the fibers must be <0.20 dB at 1550 nm for singlemode fiber. The cable must not exhibit evidence of cracking or splitting.

The finished cable must withstand a tensile load of 610 lb without exhibiting an average increase in attenuation of greater than 0.20 dB (singlemode). 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.

86-2.20B(7)(m) Packaging and Shipping

You must submit documentation of compliance with the required specifications to the Engineer prior to ordering the material.

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. 10 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, the Contractor's 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 waterproof envelope must be only removed by the Engineer, upon delivery to the job site for testing.

The minimum hub diameter of the reel must be at least thirty times the diameter of the cable. The FO 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.

You must furnish installation procedures and technical support information to the Engineer at the time of delivery.

86-2.20B(8) Labeling

You must label all fiber optic cabling in a consistent manner. All tags must be of a material designed for long term permanent labeling of fiber optic cables and must be marked with permanent ink on non-metal types, or embossed lettering on metal tags. Metal tags must be constructed of stainless steel. Non-metal label materials must be approved by the Engineer. Labels must be affixed to the cable per the manufacturer’s recommendations and must not be affixed in a manner which will cause damage to the fiber. Handwritten labels must not be allowed.

86-2.20B(8)(a) Identification for Cables, Jumpers, and Pigtails

Labeling of the backbone and fiber optic cables must conform to following unique identification code elements:

Abbreviations	
HUB	HUB.X
VAULT	VXX.X
CAMERA	CXX.X
TOS	TXX.X
PULLBOX	FXX.X
VDS	IXX.X
RAMP METER	RXX.X

The X’s denote the post miles of the above elements.

Pigtails			
Cable Type	From	To	Fiber No.
X	-XXX.X	-XXX.X	-XX

A label must be placed on each pigtail near the connector showing the point of origin of the link and the termination of the link. A label with the fiber number being spliced must be placed on the end of the pigtail near the splice.

Example labeling: C-HUB.A-C44.5-10.

Splice Vaults		
Cable Type	From	To
X	-XXX.X	-XXX.X

A label must be placed on Type D and F cables as they enter and exit each splice vault. A label must be placed on the cable inside each WVDS, ICC, CMS, Data Node, Mini Hub, Count Station, Camera, Traffic Signal and Ramp Meter controller cabinet.

Example labeling: F-HUB.D-HUB.C
Example labeling: D-C044.5-V044.8

Jumpers	
Equipment From	Equipment To
ID No. by	ID No. by

Both ends must be labeled near the connector. The label must be the same on both ends and denote where the ends of the jumper are plugged into.

86-2.20B(8)(b) Label Placement for Cable to Cable Splices

All cable jackets entering the splice enclosure must be labeled in accordance with the unique identification code element method described elsewhere in these special provisions.

A label must be placed on each splice tray explaining the splices in the tray.

86-2.20B(8)(c) Label Placement for Cable to Fiber Distribution Units

The cable jackets must be clearly labeled at entry to the FDU in accordance with the unique identification code element method described elsewhere in these special provisions. In addition, each fiber must be labeled with the Fiber ID and pigtails must be labeled at the connector with the Fiber ID. The FDU must be clearly labeled with the Cable ID on the face of the FDU. If multiple cables are connected to the FDU, each block of connectors relating to each individual cable must be clearly identified by a single label with the Cable ID. Individual connections must be clearly marked on the face of the FDU in the designated area with the Fiber ID.

86-2.20B(9) Passive Cable Assemblies and Components

The fiber optic 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, non-corroding, with a design life of at least 20 years.

86-2.20B(10) Fiber Optic Cable Terminations

Fiber optic cable must continue within the conduit or innerduct 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 data nodes, mini hubs, CMS cabinets, camera sites, etc.

86-2.20B(10) Cable Termination

At the FDU or ITU, 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 or ITU manufacturer which allows the tubes to be secured to the splice trays. Each buffer tube must be secured to the splice tray in which it is to be spliced. 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 "Splicing," elsewhere in these special provisions

When applicable, moisture blocking gel must be removed from the exposed buffer tubes and fibers. The transition from the buffer tube to the bundle of jacketed fibers must be treated by an accepted procedure for sleeve tubing, shrink tube and silicone blocking of the transition to prevent future gel leak. Manufacturer directions must be followed to ensure that throughout the specified temperature range gel will not flow from the end of the buffer tube. The individual fibers must be stripped and prepared for splicing.

Factory terminated pigtails must then be spliced and placed in the splice tray.

86-2.20B(11) Distribution Interconnect Package

Distribution involves connecting the fibers to locations shown on the plans. The distribution interconnect package consists of FDU's and ITU's with connector panels, couplers, splice enclosures, splice trays, fiber optic pigtails and cable assemblies with connectors. The distribution interconnect package must be assembled and tested by a company that is regularly engaged in the assembly of these packages. Attention is directed to "Fiber Optic Testing" elsewhere in these special provisions. All distribution components must be products of the same manufacturers, who are regularly engaged in the production of these components, and the respective manufacturers must have quality assurance programs.

86-2.20B(11)(a) Interconnect and Termination Unit

You must furnish and install all related equipment to interface the rack mount interconnect and termination unit (ITU) to the incoming fiber optic communications cable and the patchcord fiber optic cable.

The ITU must be a modular enclosure that provides interconnect capability of one multi-fiber cable to a minimum of 12 single-fiber optic cable.

The ITU must be environmentally sealed and contain grommets at the cable entrances to prevent any ingress of dirt or moisture. Strain relief must be provided for the fiber optic cable.

The ITU must contain a splice tray, connector panel and the appropriate number of pigtails which will be fusion spliced to the incoming fiber cable.

Each fiber must be fusion spliced to a pigtail with a factory installed and polished SC connector. Each pigtail must be labeled and secured onto cable as described in these special provisions. Brackets must be provided to spool the incoming fiber optic cable to minimum of 3 turns before separating out individual fibers to the connector panel.

The ITU must be packaged in a rack unit with dimensions of 17 inch (W) X 1.8 inch(H) X 11 inch (D) having metal housing slide-out shelf. The ITU must contain grommets at cable entrances and provide strain relief for the fiber cable. The ITU must accommodate 12 single mode fibers having SC type connector feed through adapters and 12 interconnection points or 12 splices. The components of the passive interconnect package must be installed in the ITU.

The ITU must be a metal enclosure with a hinged door. The door must have a latch or thumbscrew to hold the door in the closed position. An opening must be provided on the back side of the incoming fiber optic communications cable. Connector panels (for up to 12 SC connectors) must be provided inside the enclosure. Strain relief must be provided for the incoming fiber optic cable. A guard must be provided to protect the patchcord fiber optic cables plugged into this enclosure.

86-2.20B(11)(b) Fiber Distribution Unit

You must furnish and install all components to terminate the incoming fiber optic communication cables.

FDU Type	Accomodates Termination of
A	24 SMFO fibers
D	12 SMFO fibers
F	72 SMFO fibers

The fiber distribution unit (FDU) must include the following:

1. A patch panel to terminate the appropriate number of singlemode fibers with SC type connector feed through couplers.
2. Splice trays.
3. Storage for splice trays.
4. A slide out metal drawer for the storage of spare jumpers.

Strain relief must be provided for the incoming fiber optic cable. Cable accesses must have rubber grommets or similar material to prevent the cable from coming in contact with bear metal. All fibers must be terminated and individually identified in the FDU and on the patch panel.

The patch panel must be hinged or have coupler plates to provide easy access and maintenance. Brackets must be provided to spool the incoming fiber a minimum of two turns, each turn must not be less than 1 foot, before separating out individual fibers to the splice tray.

The FDU must be 19 inch rack mountable.

The FDU must not exceed 4" in height and 15" in depth.

The front and back covers of the FDU must be retractable or removable to facilitate internal installation.

86-2.20B(11)(c) Splice Enclosures

The fiber optic field splices must be enclosed in splice enclosures which must be complete with splice organizer trays, brackets, clips, cable ties, seals and sealant, as needed. The splice enclosure must be suitable for a direct burial or pull box application. You must provide manufacturer's installation instructions 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 on the plans, designated by the Engineer, or described in these special provisions.

The fiber optic splice enclosure must consist of an outer enclosure, an inner enclosure and splice trays, and must conform to the following special provisions.

The fiber optic splice enclosure must be suitable for a temperature range of 32°F to 122°F.

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 be not more than 36 inches in length and not more than 8 inches in diameter. Two outer enclosures 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. The enclosures must be designed for butt splicing.

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 0.4 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

All materials in the enclosures must be nonreactive and must not support galvanic cell action. The outer enclosure must be compatible with the other enclosure components, the inner enclosure, splice trays, and cables.

The end plate must consist of two sections and must have capacity for 2 fiber optic trunk communication cables and 2 fiber optic pigtails communication.

The outer enclosure must protect the splices from mechanical damage, provide strain relief for the cable, and be resistant to salt corrosion.

The outer enclosure must be waterproof, re-enterable, and be sealed with a gasket. The outer enclosure must be flash-tested at 14.9 psi.

The inner enclosure must be of metallic construction. The inner enclosure must be compatible with the outer enclosure and the splice trays and must allow access to and removal of individual splice trays. The splice trays must be compatible with the inner enclosure and must be constructed of rigid plastic or metal.

Adequate splice trays must be provided to splice all fibers of the largest fiber optic cable, plus 12 pigtails.

Each splice must be individually mounted and mechanically protected in the splice tray.

You must install the fiber splice enclosure as shown in the plans and in the splice vaults where splicing is required. The fiber optic splice enclosures must be securely fastened to the splice vault using standard hardware found in communication manholes.

You must provide all mounting hardware required to securely mount the enclosures to the splice vault. Each splice enclosure must be filled to capacity with splice trays.

The fiber splice enclosure must be mounted horizontally in a manner that allows the cables to enter at the end of the enclosure. Not less than 30 feet of each cable must be coiled in the vault to allow the fiber splice enclosure to be removed for future splicing.

The unprotected fibers exposed for splicing within the enclosure must be protected from mechanical damage using the fiber support tube or tubes and must be secured within the fiber splice enclosure.

Upon completion of the splices, the splice trays must be secured to the inner enclosure.

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.

The fiber optic splice enclosure model SCF canister type from Siecor, or model FibrDome from 3M are recommended.

You must verify the quality of each splice prior to sealing the splice enclosure. The splice enclosure must not be sealed until link testing is performed and is approved by the Engineer.

86-2.20B(11)(d) Splice Trays

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 that an inadvertent tug on the pigtail will damage the fiber. The splice tray cover may 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 within the tray
3. Stackable with a snap-on hinge cover
4. Buffer tubes securable with channel straps
5. Must be able to accommodate a fusion splice with the addition of an alternative splice holder
6. 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.

86-2.20B(11)(e) Fiber Optic Cable Assemblies

Cable assemblies (jumpers and pigtails) must be products of the same manufacturer. The cable used for cable assemblies must comply with the performance specifications of these special provisions for the fiber optic cable being connected.

86-2.20B(11)(f) Pigtails

Pigtails must be of simplex (one fiber) construction, in 900 µm tight buffer form, surrounded by aramid for strength, with a PVC jacket with manufacturer identification information, and a nominal outer jacket diameter of 0.12 inch. Singlemode simplex cable jackets must be yellow in color. All pigtails must be factory terminated and 3 feet in length.

86-2.20B(11)(g) Jumpers

Jumpers may be of simplex or duplex design. Duplex jumpers must be of duplex round cable construction, and must not have zipcord (Siamese) construction. All jumpers must be at least 6 feet in length, sufficient to avoid stress and allow orderly routing.

The outer jacket of duplex jumpers must be colored according to the singlemode color (yellow) specified above. The two inner simplex jackets must be contrasting colors to provide easy visual identification for polarity.

86-2.20B(11)(h) SC Connectors

Connectors must be of the ceramic ferrule SC type for SM. Indoor SC connector body housings must be either nickel plated zinc or glass reinforced polymer construction. Outdoor SC connector body housing must be glass reinforced polymer. SC type connectors must meet the requirements of EIA/TIA-568A except as specified below.

The associated coupler must be of the same material as the connector housing.

All fiber optic connectors must be the 0.1 inch SC connector ferrule type with Zirconia Ceramic material with a PC (Physical Contact) pre-radiused tip.

The SC connector operating temperature range must be -40 to +70 C. Insertion loss must not exceed 0.4 dB for singlemode, and the return reflection loss on singlemode connectors must be at least -55 dB. Connection durability must be less than a 0.2 dB change per 500 mating cycles per EIA-455-21A (FOTP-21).

All terminations must provide a minimum 50 lbs pull out strength. You must document and submit factory test results to the Engineer prior to installing any of the connectors. Singlemode connectors must have a yellow color on the body and/or boot that renders them easily identifiable.

Field terminations must be limited to splicing of adjoining cable ends and/or cables to SC pigtails.

86-2.20B(11)(i) LC Connectors

LC type connectors must meet the requirements of EIA/TIA-568 except as specified below. LC connector body housings must be of polymer construction.

All LC fiber optic connectors must have a 0.05 in diameter, Zirconia Ceramic, LC connector ferrule with a PC (Physical Contact) pre-radius tip.

The LC connector operating temperature range must be -40 to +70 C. Insertion loss must not exceed 0.4 dB for singlemode, and the return reflection loss on singlemode connectors must be at least -55 dB. Connection durability must be less than a 0.2 dB change per 500 mating cycles per EIA-455-21A (FOTP-21).

You must document and submit factory test results to the Engineer prior to installing any of the connectors. Singlemode connectors must have a yellow color on the body and/or boot that renders them easily identifiable.

86-2.20B(11)(j) SC Couplers

The SC couplers must be made of polymer construction that is consistent with the material forming the associated SC connector body. The design mechanism for mounting the couplers to the ITU connector panel may be achievable using metal clips or fasteners but must coincide with the ITU panel punch-outs.

All coupler sleeves must be of the cylinder split ceramic or clover leaf design.

r**86-2.20B(12) Fiber Optic Splice Vault**

Splice vaults must be the size shown on the plans and must conform to Section 86-2.06, "Pull Boxes," of the Standard Specifications and these special provisions. Enclosures, covers and extensions must be concrete gray color. Splice vaults must be constructed of reinforced portland cement concrete and must have a minimum inside clearance of 3 feet (W) x 5 feet (L) x 5 feet (D).

Covers must be 2 piece torsion assisted sections with a cast in frame. Cover marking must be "CALTRANS FIBER OPTIC" on each cover section. Each cover section 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. Covers must be hot dipped galvanized steel.

Splice vaults must be installed as shown on the plans. Splice vaults and covers must have an AASHTO HS 20-44 rating.

Splice vaults must be installed at grade in paved areas, and 1 inch above grade in unpaved areas.

Splice vaults shown on the plans in the shoulder are shown for general location only. Exact location will be determined by the Engineer.

Metallic or non-metallic cable racks must be cast-in on the interior of all sides of the splice vaults. Racks must be capable of supporting a load of 100 lb-f minimum, per rack arm. Racks must be supplied in lengths appropriate for the vault in which they will be placed. Rack arms must not be less than 6 inches in length. Metallic cable racks must be fabricated from ASTM A 36 steel plate and must be hot-dipped galvanized after fabrication. Metallic cable racks must be bonded and grounded. Steel plate, hardware and galvanizing must comply with the specifications in Section 75, "Miscellaneous Metal," of the Standard Specifications.

86-2.20C CONSTRUCTION

86-2.20C(1) Cable Installation

Installation procedures must be in conformance with the procedures specified by the cable manufacturer for the specific cable being installed. All cables must be installed by a certified fiber optic cable installer or you must have a representative from the cable manufacturer present during cable installation. You must submit the manufacturer's recommended procedures for pulling fiber optic cable at least 10 working days prior to installing cable. Mechanical aids may be used provided that a tension measuring device and a breakaway swivel are placed in tension to the end of the cable. The tension in the cable must not exceed 500 lbf or the manufacturer's recommended pulling tension, whichever is less.

During cable installation, the bend radius must be maintained at a minimum of twenty times the outside diameter. 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.

Fiber optic cable must be installed using a cable pulling lubricant recommended by the fiber optic cable and/or the innerduct manufacturer, and a pull tape conforming to the provisions described in Section 86-2.05 "Conduit," of the Standard Specifications. Your personnel must be stationed at each splice vault and pullbox through which the cable is to be pulled to lubricate and prevent kinking or other damage.

Fiber optic cable must be installed without splices except where specifically allowed on the plans or approved by the Engineer. Any midspan access splice or FDU termination must involve only those fibers being spliced as shown on the plans. Cable splices must be located in splice enclosures, installed in splice vaults shown on the plans. A minimum of 120 feet of slack must be provided for each fiber optic cable at each splice vault. Slack must be divided equally on each side of the fiber optic splice enclosure.

Unless shown or provided otherwise, only fiber optic cable and tracer wire must be installed in an innerduct. Pulling a separate fiber optic cable into a spare duct to replace damaged fiber will not be allowed.

At your option, the fiber may be installed using the air blown method. If integral innerduct is used, the duct splice points or any temporary splices of innerduct used for installation must withstand a static air pressure of 110 pounds per square inch.

The fiber installation equipment must incorporate a mechanical drive unit or pusher, which feeds cable into the pressurized innerduct to provide a sufficient push force on the cable, which is coupled with the drag force created by the high-speed airflow. The unit must be equipped with controls to regulate the flow rate of compressed air entering the duct and any hydraulic or pneumatic pressure applied to the cable. It must accommodate longitudinally ribbed, or smooth wall ducts from nominal 0.63 inch to 2 inch inner diameter. Mid assist or cascading of equipment must be for the installation of long cable runs. The equipment must incorporate safety shutoff valves to disable the system in the event of sudden changes in pneumatic or hydraulic pressure.

The equipment must not require the use of a piston or any other air capturing device to impose a pulling force at the front end of the cable, which also significantly restricts the free flow of air through the inner duct. It must incorporate the use of a counting device to determine the speed of the cable during installation and the length of the cable installed.

86-2.20C(2) Conduit Installation

Minimum conduit bend radius must be 10 times trade diameter of the conduit.

Conduit trenches in or adjacent to paved shoulders must be backfilled within 3 calendar days.

All jacked conduit must be Type 1. No trenching will be allowed across freeway lanes or ramps.

86-2.20C(3) Innerduct Installation

Immediately prior to installing innerducts, all conduits must be blown out with compressed air until all foreign material is removed. After cables, conductors or innerduct have been installed, the ends of innerducts must be sealed with an approved type of sealing plugs.

A manufacturer recommended lubricant must be applied between the innerducts and the conduit during installation to reduce friction.

Installation procedures must conform to the procedures specified by the innerduct manufacturer.

Immediately prior to installing cables, innerduct must be blown out with compressed air until all foreign material is removed. After cables have been installed, the ends of innerducts must be sealed with an approved type of rubber conduit plug.

When Installed within a conduit run,E each innerduct must be one continuous unit , between splice vaults and between splice vaults to cabinets. When using the direct burial method, up to 2 innerduct splices will be allowed between splice vaults, with the approval of the Engineer. Innerduct splices must be done with an approved coupler. After installation of the coupler, one foot of innerduct before and after the coupler, must be encased in a minimum of 6 inches of concrete on top, bottom and sides.

No trenching will be allowed across freeway ramps. When installing innerducts under freeway ramps, you must install innerducts in a 4 inch jacked conduit.

When using the direct burial method method for innerduct, place a minimum of 2 inches of clean imported sand bedding in the trench before installing Innerduct, place a minimum of 4 inches of same material over the innerduct

When innerduct is installed in conduit using mechanical assistance, a dynamometer must be used to record installation tension and a tension limiting device must be used to prevent exceeding the maximum pulling tension during installation. The tension must be set to the manufacturer's maximum limit. The maximum pulling tension must be recorded for each innerduct run. The innerduct must not be stressed beyond the maximum bending radius allowed by either the innerduct or fiber optic cable manufacturer.

86-2.20C(4) Splicing

Field splices must be done either in splice vaults or cabinets as shown on the plans. All splices in splice vaults must be done in splice trays, housed in splice enclosures. All splices in cabinets must be done in splice trays housed in FDU’s or ITU’s.

Unless otherwise specified, fiber splices must be the 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. A test of a splice in a pigtail must have a minimum 1000 foot single mode launch cable attached to the fiber being tested. The splice loss test values must be tabulated in a Microsoft Excel compatible computer spreadsheet format and provided to the Engineer for approval.

All splices must be protected with a metal reinforced thermal shrink sleeve.

The mid-span access method must be used to access the individual fibers in a cable for splicing to another cable as shown on the plans. Cable manufacturers recommended procedures and approved tools must be used when performing a mid-span access. Only the fibers to be spliced may be cut. All measures must be taken to avoid damaging buffer tubes and individual fibers not being used in the mid-span access.

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 discernable tensile force on the optical fiber.

You will be allowed to splice a total 2fibers to repair any damage done during mid-span access splicing without penalty. Any single fiber may not have more than 3 unplanned splices. If any fiber requires more than 3 unplanned splices, the entire length of fiber optic cable must be replaced at your expense.

86-2.20D PAYMENT

Not Used

Add to section 86-2.21:

86-2.21 Photovoltaic Power Supply

86-2.21A General

86-2.21A(1) Summary

Section 86-2.21 includes specifications for installing photovoltaic (PV) power supply.

86-2.21A(2) Submittals

Submit list of equipment, materials, drawings and cut sheets for all proposed electrical components of the PV power supply. Allow 5 working days for the review of the submittals.

Deliver Parts list and the operating, maintenance and service instructions packaged with or accompanying the equipment installed on the project before acceptance of the project.

86-2.21A(3) Quality Control and Assurance

Solar spectral irradiance must comply with ASTM E891 and E892.

The PV panel assembly must comply with Mil standard 810 for salt tests.

86-2.21A(4) Warranty

Furnish a 2-year replacement warranty from the manufacturer for all system components and 10-year warranty from the manufacturer for PV panels against any defects or failures. The effective date of the warranty is the date of acceptance of the installation. Replacement parts to arrive within 10 days after receipt of the failed parts. The Department does not pay for the replacement. Replacement parts to be delivered to the Department Maintenance Electrical Shop located at:

District 8-Electrical Maintenance Yard
175 West Cluster Street
San Bernardino, CA 92408

86-2.21B Materials

86-2.21B(1) General

Each PV power supply must include a panel support structure, PV panels, batteries, a charge controller, a NEMA 3R enclosure and components. The components must be suitable for outdoor use, and UL approved. Provide grounding of the PV supply system.

Each PV power supply must provide 12 V(dc) to the system 24 hours per day and must be capable of operating 4 days without additional charge from the PV panels. A load/charge controller must charge the batteries during daytime while providing 12 V(dc) to the system 24 hours per day.

The PV power supply must operate in ambient temperatures from -34 to 158 degrees F.

Each PV Power Supply must include the following items:

Item	Quantity
Panel Support Structure	1
Photovoltaic Panel	3
Battery	3
Load/Charge Controller	1
Power Inverter	1

86-2.21B(2) Panel Support Structure

The PV panels must withstand 100 mph basic wind speed and 3 second gust per AASHTO.

86-2.21B(3) Photovoltaic Panels

Each PV panel must meet the following requirements:

Parameter	Minimum Requirements
Peak power output *	140watts *
Voltage at maximum power	17.6 V(dc) *
Current at maximum power	8A *
Dimensions	As shown
Hailstone impact resistance	1" diameter at 50 mph

* Minimum Requirements are based on a 140 watt PV panel. Higher wattage PV panels are acceptable.

The PV panels must contain single crystal or multi crystal technology and provide high efficiency and long life. The cells must have texture and coating of an anti-reflective film. The cells must have multiple redundant contacts and must be electrically matched for increased efficiency. A rugged aluminum vented backing must be riveted to an aluminum panel equipped with welded aluminum brackets for attachment to the bracket arm.

Hardware must be of stainless steel.

86-2.21B(4) Batteries

Batteries must be maintenance free, sealed, absorbed glass mat, deep cycle, and heavy duty. Each battery must meet the following requirements:

Parameter	Minimum Requirements
Voltage	12 V(dc)
Storage capacity	100 Ah minimum at a 100 hour discharge rate
Maximum discharge current for 5 seconds	450 A minimum

They must be identical in make and model. The battery must be 100 percent recyclable and capable of a minimum of 1,000 cycles in this application.

86-2.21B(5) Charge Controller

Each charge controller must regulate the voltage and current coming from the PV panels going to the batteries and to the load.

Each Charge Controller must use Maximum Power Point Tracking (MPPT) Technology.

Each charge controller must meet the following minimum requirements:

Parameter	Minimum Requirements
Rated solar current	15 A
Rated load current	15 A
System voltage	12 / 24 V(dc)
Digital meter	Displays battery voltage, solar current and load current (Optional)
Connections	Screw terminals for PV panels, battery and load
LED indicators	Charging, battery status and temperature sensor
Load disconnect switch	Disconnects the load or both the load and solar
Self-test	Tests all charge controller internal circuits.
Grounding	UL Standard 1741

86-2.21B(6) Power Inverter

The Power Inverter (PI) must consist of components designed for outdoor use and approved by Underwriters Laboratory.

The PI must meet the following minimum requirements:

Parameter	Minimum Requirements
Continuous Power Rating	200 Watts @ 25℃
Peak Power Rating	400 Watts @ 25℃
Input Voltage	10-15 VDC
A/C Output Voltage	115V +/– 10%
AC Output Frequency	60 Hz +/– 0.1%
Waveform	sine wave
Peak Efficiency	92%
Low Voltage Disconnect	10-11 VDC
Low Voltage Reconnect	11.5-12.5 VDC
Operating Environment	Ambient Operating Temp –10℃ to +50℃ Humidity 100% (non-condensing)

86-2.21C Construction

Set orientation of PV panels directly south to maximize the collection of solar energy. Mount PV panels per approved engineering drawings.

Connect the batteries in parallel to provide 12 V(dc). Include a glass type fuse holder specified for the given model system.

Provide electrical grounding to panel assembly and all metal surfaces.

86-2.21D Payment

Not Used.

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. Equipment shelves, qty 2
4. Dual fan assembly with thermostatic control
5. Drawer shelf, qty 1
6. Input panel

Cabinets must be listed on the Authorized Material List.

Before shipping to the job site, submit each 334L cabinet to METS for acceptance testing.

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. One 30 A, 1-pole, 120 V(ac) main circuit breaker
2 One duplex GFCI NEMA 15 A, receptacle (front mount)

Furnish 2 equipment 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

Add to section 3.05:

86-3.05 10G HUB FIBER OPTIC SWITCH

86-3.05A General

Section 86-3.05 includes specifications for furnishing and installing the10G Hub Fiber Optic Switch (10G HFOS)

86-3.05A(1) Summary

The 10G HFOS provides network connectivity with fiber optic and Ethernet based equipment.

86-3.05A(2) Training

Provide a minimum of 30 hours of training by a certified manufacturer's representative for up to 10 students selected by the Engineer. Provide materials and equipment for the training. Provide the Engineer 15 days' notice before the training. Which must be completed a minimum of 3 weeks before the installation of any switches or routing equipment, which must be completed a minimum of 3 weeks before the installation of any switches or routing equipment. The time of the training must be agreed upon by the Engineer and you. If no agreement can be reached, the Engineer will determine the time. The location of the training must be at:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

The content of the training must include:

Subject	Minimum Training Content
Overview of Installed Network	1. Device Specific Configuration of Various Protocols and Security Features.
	2. Management functions and command line interface (CLI) syntax
Multicast Layer 2 and 3 Network Design, Implementation and Troubleshooting	1. Introduce IP Multicast Services
	2. IP Multicast Benefits and Associated Caveats
	3. Describe Various Types of Multicast Applications in order to Understand the IP Multicast Conceptual Model and Its Implementation.
	4. Describe Multicast Best Practices for Implementation in a OSPF Multi-area Routed Network
	5. Multicast Security Practices and Troubleshooting

86-3.05A(3) Warranty

Furnish a 5 year replacement warranty from the manufacturer against any defects in materials or workmanship. The effective date of the warranty is the date of contract acceptance. Replacement parts must arrive within 5 business days after receipt of the failed parts. The Department does not pay for replacement parts. Deliver replacement parts to:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

86-3.05A(4)(a) Testing

Comply with Section 86-2.17.

86-3.05B Materials

86-3.05B(1) General

Physical Requirements	
Description	Parameter
Ethernet Electrical Ports	Minimum 10-(10/100/1000 BASE-TX)
Single Mode Optical Ports	Minimum 4- (100Base-FX)
Single Mode Optical Ports	Minimum 4- (1000Base, Long Haul)
Single Mode Optical Ports	Minimum 3 - (10GBase, Extended Range)
Console Port	1
Input Voltage	120 V AC

Operational Requirements	
Description	Parameters
Electrical Port Configuration	1. 10/100/1000 Base-T
	2. RJ-45 Female Connector
	3. Automatic and User-selectable Speed Setting
	4. Automatic and User-selectable half/full duplex setting
	5. Port Aggregation with VLAN support
	6. Port Mirroring

Operational Requirements	
Description	Parameters
Optical Port Configuration	1. 100Base-FX/1000Base-LH/10GBase-ER
	2. 8 Miles Minimum Distance for SM 100FX (1310 nm)
	3. 18 Miles Minimum Distance for SM 1000LH (1310 nm)
	4. 24 Miles Minimum Distance for SM 10GER (1550 nm)
	5. Port Aggregation with VLAN support
	6. Port Mirroring

Management and Control Function Requirements
1. HTTP/Web Browser Based Management Interface
2. Telnet and SSH for Remote Management
3. TFTP for Remote Firmware Upgrades
4. SNMP for Network Management
5. Console Connection for Local Management
6. Packet Filtering and Port Security
7. Text Based Command Line Interface
8. Text Based Configuration Files

Protocol Requirements
1. Institute of Electrical and Electronics Engineers (IEEE) 802.3
2. IEEE 802.3u 100Base-FX
3. IEEE 802.3x Flow Control
4. IEEE 802.1Q Virtual Local Area Network (VLAN) Tagging
5. IEEE 802.1D Spanning Tree Protocol (STP, RSTP, MSTP)
6. IEEE 802.1P Quality of Service (QoS)
7. IEEE 802 1AB Link Layer Discovery Protocol (LLDP)

Operational Requirements	
Description	Parameters
Layer 3 Routing	1. Static Routing, RIP (v1, v2), OSPF (v2)
	2. IGMP (v1, v2 and v3) and IGMP Snooping.
	3. PIM-SM, PIM-DM and DVMRP
	4. Generic UDP relay (including DHCP relay)
	5. TCP/IP Stack
	6. ARP Resilience
	7. VRRP (v2) Layer-3 Routing (IPv6) IP Routing

Minimum LED Status Indications
Power
Link
Fiber Port Status

Environmental Requirements	
Description	Parameter
Operating Temperature Range	From -10 to +60 ℃
Storage Temperature Range	From -10 to +85 ℃
Hardened	Meet NEMA TS-1/TS-2 Standard
Relative Humidity	From 10 to 95 percent, non-condensing

86-3.05C Construction

The installation of the switch must be according to the plans and the manufacturer's instructions.

Deliver switch to the TMC a minimum of 2 weeks prior to installation in the field for configuration:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

The 10G HFOS must be the 19” rack mountable type. The placement of the 10G HFOS must allow for provisions for cable installation and maintenance.

86-3.05D Payment

Not Used

Add to section 86-3.06:

86-3.06 DATA NODE FIBER OPTIC SWITCH

86-3.06A General

Section 86-3.06 includes specifications for furnishing and installing the Data Node Fiber Optic Switch (DNFOS)

86-3.06A(1) Summary

The DNFOS provides network connectivity with fiber optic and Ethernet based equipment.

86-3.06A(2) Warranty

Furnish a 5 year replacement warranty from the manufacturer against any defects in materials or workmanship. The effective date of the warranty is the date of contract acceptance. Replacement parts must arrive within 5 business days after receipt of the failed parts. The Department does not pay for replacement parts. Deliver replacement parts to:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

86-3.06A(3) Testing

Comply with Section 86-2.17.

86-3.06B Materials

86-3.06B(1) General

Physical Requirements	
Description	Parameter
Ethernet Electrical Ports	Minimum 10 (10/100 BASE-TX)
Single Mode Optical Ports	Minimum 4 (100Base-FX)
Single Mode Optical Ports	Minimum 2 (1000Base-Long Haul)
EIA-232 Console Port	1
Input Voltage	12 V DC, 120 V AC

Operational Requirements	
Description	Parameters
Electrical Port Configuration	1. 10/100 Base-TX
	2. RJ-45 Female Connector
	3. Automatic and User-selectable Speed Setting
	4. Automatic and User-selectable half/full duplex setting
	5. Port Aggregation with VLAN support
	6. Port Mirroring

Operational Requirements	
Description	Parameters
Optical Port Configuration	1. 100Base-FX/1000Base-LH
	2. 8 Miles Minimum Distance for SM 100FX
	3. 18 Miles Minimum Distance for SM 1000LH
	4. Automatic and User-selectable half/full duplex setting
	5. Port Aggregation with VLAN support
	6. Port Mirroring

Management and Control Function Requirements
1. HTTP/Web Browser Based Management Interface
2. Telnetor SSH for Remote Management
3. TFTP for Remote Firmware Upgrades
4. SNMP for Network Management
5. Console Connection for Local Management
6. Packet Filtering and Port Security
7. Text Based Command Line Interface
8. Text Based Configuration Files

Protocol Requirements
1. Institute of Electrical and Electronics Engineers (IEEE) 802.3
2. IEEE 802.3u 100Base-FX
3. IEEE 802.3x Flow Control
4. IEEE 802.1Q Virtual Local Area Network (VLAN) Tagging
5. IEEE 802.1D Spanning Tree Protocol (STP, RSTP, MSTP)
6. IEEE 802.1P Quality of Service (QoS)
7. IEEE 802.3u 100Base-T
8. IEEE 802.1AB Link Layer Discovery Protocol (LLDP

Minimum LED Status Indications
Power
Link
Fiber Port Status

Environmental Requirements	
Description	Parameter
Operating Temperature Range	From -10 to +60 °C
Relative Humidity	From 10 to 95 percent, non-condensing
Hardened	Meet NEMA TS-1/TS-2 Standard

86-3.06C Construction

The installation of the switch must be according to the plans and the manufacturer's instructions.

Deliver switch to the TMC a minimum of 2 weeks prior to installation in the field for configuration:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

The DNFOS must be the 19" rack mountable type. The placement of the DNFOS must allow for provisions for cable installation and maintenance.

86-3.06D Payment

Not Used

Add to section 86-3.07:

86-3.07 ETHERNET FIBER OPTIC SWITCH

86-3.07A General

Section 86-3.07 includes specifications for furnishing and installing the Ethernet Fiber Optic Switch (EFOS)

86-3.07A(1) Summary

The EFOS provides network connectivity with fiber optic and Ethernet based equipment.

86-3.07A(2) Warranty

Furnish a 5 year replacement warranty from the manufacturer against any defects in materials or workmanship. The effective date of the warranty is the date of contract acceptance. Replacement parts must arrive within 5 business days after receipt of the failed parts. The Department does not pay for replacement parts. Deliver replacement parts to:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

86-3.07A(3) Testing

Comply with Section 86-2.17.

86-3.07B Materials

86-3.07B(1) General

Physical Requirements	
Description	Parameter
Ethernet Electrical Ports	Minimum 6 (10/100 BASE-TX)
Single Mode Optical Ports	Minimum 2 (100Base-FX) (with 2 FO Connections for each port)
Console Port	1
Input Voltage	12 V DC, 120 V AC

Operational Requirements	
Description	Parameters
Electrical Port Configuration	1. 10/100 Base-TX
	2. RJ-45 Female Connector
	3. Automatic and user-selectable speed setting
	4. Automatic and user-selectable half/full duplex setting
	5. Port aggregation with VLAN support
	6. Port Mirroring

Operational Requirements	
Description	Parameters
Optical Port Configuration	1. 100Base-FX
	2. 8 Miles Minimum Distance for SM 100FX
	3. Fiber Optic Connectors for SC or LC
	4. Port aggregation with VLAN support
	5. Port Mirroring

Management and Control Function Requirements
1. HTTP/Web Browser Based Management Interface
2. Telnet or SSH for Remote Management
3. TFTP for Remote Firmware Upgrades
4. SNMP for Network Management
5. Console connection for local management
6. Packet Filtering and Port Security
7. Text Based Command Line Interface
8. Text Based Configuration Files

Protocol Requirements
1. Institute of Electrical and Electronics Engineers (IEEE) 802.3
2. IEEE 802.3u 100Base-FX
3. IEEE 802.3x Flow Control
4. IEEE 802.1Q Virtual Local Area Network (VLAN) Tagging
5. IEEE 802.1D Spanning Tree Protocol (STP, RSTP, MSTP)
6. IEEE 802.1P Quality of Service (QoS)
7. IEEE 802.3u 100Base-T
8. IEEE 802.1AB Link Layer Discovery Protocol (LLDP)

Minimum LED Status Indications
Power
Link
Fiber Port Status

Environmental Requirements	
Description	Parameter
Operating Temperature Range	From -10 to +60 °C
Relative Humidity	From 10 to 95 percent, non-condensing
Hardened	Meet NEMA TS-1/TS-2 Standard

86-3.07C Construction

The installation of the switch must be according to the plans and the manufacturer's instructions.

Deliver switch to the TMC a minimum of 2 weeks prior to installation in the field for configuration:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

The EFOS must be the DIN rail mount type. The placement of the EFOS must allow for provisions for cable installation and maintenance.

86-3.07D Payment

Not Used

Add to section 86-3.08:

86-3.08 ETHERNET SWITCH

86-3.08A General

Section 86-3.08 includes specifications for furnishing and installing the Ethernet Switch (ES).

86-3.08A(1) Summary

The ES provides network connectivity with other Ethernet based equipment.

86-3.08A(2) Warranty

Furnish a 5 year replacement warranty from the manufacturer against any defects in materials or workmanship. The effective date of the warranty is the date of contract acceptance. Replacement parts must arrive within 5 business days after receipt of the failed parts. The Department does not pay for replacement parts. Deliver replacement parts to:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

86-3.08A(3) Testing

Comply with Section 86-2.17.

86-3.08B Materials

86-3.08B(1) General

Physical Requirements	
Description	Parameter
Ethernet Electrical Ports	Minimum 6 (10/100 BASE-TX)
Console Port	1
Input Voltage	12 V DC, 120 V AC

Operational Requirements	
Description	Parameters
Port Configuration	1. 10/100 Base-TX
	2. RJ-45 Female Connector
	3. Automatic and User-selectable speed setting
	4. Automatic and User-selectable half/full duplex setting
	5. Port Aggregation with VLAN support
	6. Port Mirroring

Management and Control Function Requirements
1. HTTP/Web Browser Based Management Interface
2. Telnet or SSH for Remote Management
3. TFTP for Remote Firmware Upgrades
4. SNMP for Network Management
5. Console Connection for Local Management
6. Packet Filtering and Port Security
7. Text Based Command Line Interface
8. Text Based Configuration Files

Protocol Requirements
1. Institute of Electrical and Electronics Engineers (IEEE) 802.3
2. IEEE 802.3u 100Base-T
3. IEEE 802.3x Flow Control
4. IEEE 802.1Q Virtual Local Area Network (VLAN) Tagging
5. IEEE 802.1D Spanning Tree Protocol (STP, RSTP, MSTP)
6. IEEE 802.1p Quality of Service (QoS)
7. IEEE 802 1AB Link Layer Discovery Protocol (LLDP)

Environmental Requirements	
Description	Parameter
Operating Temperature Range	From -10 to +60 ℃
Relative Humidity	From 10 to 95 percent, Non-condensing
Hardened	Meet NEMA TS-1/TS-2 Standard

86-3.08C Construction

The installation of the switch must be according to the plans and the manufacturer's instructions.

Deliver switch to the TMC a minimum of 2 weeks prior to installation in the field for configuration:

District 8 - Inland Empire TMC

13892 Victoria Street

Fontana, CA 92336

The ES must be the DIN rail mount type. The placement of the ES must allow for provisions for cable installation and maintenance.

86-3.08D Payment

Not Used

Add to section 86-3.09:

86-3.09 ETHERNET CARD

86-3.09A General

86-3.09A(1) Summary

The Ethernet Card provides network connectivity to the Model 170 controller and must comply with NEMA TS1/2 Environmental Requirements for Traffic Control Equipment and the District 8 Ramp Metering Information Software System (RMI).

86-3.09A(2) Quality Control and Assurance

86-3.09A(2)(a) Acceptance Testing

Comply with Section 86-2.17.

86-3.09A(3) Warranty

Furnish a 5 year replacement warranty from the manufacturer against any defects in materials or workmanship. The effective date of the warranty is the date of contract acceptance. Replacement parts must arrive within 5 business days after receipt of the failed parts. The Department does not pay for replacement parts. Deliver replacement parts to:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

86-3.09B Materials

86-3.09B(1) General

The Ethernet Card must conform to Chapter 2, Section 5 of the TEES except for the following:

1. Environmental requirements
   1.1. Operating temperature: From -40 to 165 ℉
   1.2. Relative humidity: From 5 to 90 percent (non-condensing)

86-3.09B(2) System Compatibility

The Ethernet Card must be compatible with the existing District 8 Front End Processer (FEP) developed by:

Astart Synergistics
4809 Mt Ararat Dr,
San Diego, CA 92111
(858) 874-6543

86-3.09C Construction

Install the Ethernet Card as per the manufacturer's instructions.

86-3.09D Payment

Not used

Add to section 86-3.10:

86-3.10 RACK DISTRIBUTION SWITCH

86-3.10A General

Section 86-3.10 includes specifications for furnishing and installing the Rack Distribution Switch (RDS)

86-3.10A (1) Summary

The RDS provides network connectivity with fiber optic and Ethernet based equipment.

86-3.10A (2) Warranty

Furnish a 5 year replacement warranty from the manufacturer against any defects in materials or workmanship. The effective date of the warranty is the date of contract acceptance. Replacement parts must arrive within 5 business days after receipt of the failed parts. The Department does not pay for replacement parts. Deliver replacement parts to:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

86-3.10A (3) Testing

Comply with Section 86-2.17.

86-3.10A (4) Quality Control and Assurance

The RDS must be FCC Class A Certified and comply with UL 1950.

86-3.10B Materials

86-3.10B(1) General

Physical Requirements	
Description	Parameter
Ethernet Electrical Ports	Minimum 44 (10/100/1000 BASE-T)
Console Port	1
Input Voltage	120 V AC

Operational Requirements	
Description	Parameters
Electrical Port Configuration	1. 10/100/1000 Base-T
	2. RJ-45 Female Connector
	3. Automatic and User-selectable speed setting
	4. Automatic and User-selectable half/full duplex setting
	5. Port Aggregation with VLAN support
	6. Port Mirroring

Performance Requirements
1. Minimum 8000 Entries MAC Address Table
2. Support Jumbo Frames
3. 100 GB/s Forwarding Bandwidth (64 Byte Packets)

Management and Control Function Requirements
1. HTTP/Web Browser Based Management Interface
2. Telnet or SSH for Remote Management
3. TFTP for Remote Firmware Upgrades
4. SNMP for Network Management
5. Console connection for local management
6. Packet Filtering and Port Security
7. Text Based Command Line Interface
8. Text Based Configuration Files

Protocol Requirements
1. Institute of Electrical and Electronics Engineers (IEEE) 802.3
2. IEEE 802.3z Gigabit Ethernet
3. IEEE 802.3x Flow Control
4. IEEE 802.1Q Virtual Local Area Network (VLAN) Tagging
5. IEEE 802.1D Spanning Tree Protocol (STP, RSTP, MSTP)
6. IEEE 802.1P Quality of Service (QoS)
7. IEEE 802.3u 100Base-TX
8. IEEE 802.3ab 1000Base-T
9. IEEE 802.1AB Link Layer Discovery Protocol (LLDP)

Environmental Requirements	
Description	Parameter
Operating Temperature Range	From 0 to +40 ℃
Relative Humidity	From 5 to 80 percent, Non-condensing

86-3.10C Construction

The installation of the switch must be according to the plans and the manufacturer's instructions.

Deliver switch to the TMC a minimum of 2 weeks prior to installation in the field for configuration:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

The RDS must be the 19" rack mountable type. The placement of the RDS must allow for provisions for cable installation and maintenance and is to be installed in the communication racks located at the Inland Empire TMC.

86-3.10D Payment

Not Used

Add to section 86-3.11:

86-3.11 VIDEO DECODER

86-3.11A General

Section 86-3.11 includes specifications for furnishing and installing the Video Decoder.

86-3.11A(1) Summary

The Video Decoder must be a single channel unit designed for delivering high quality video output to analog composite video displays.

86-3.11A(2) Warranty

Furnish a 3 year replacement warranty from the manufacturer against any defects in materials or workmanship. The effective date of the warranty is the date of contract acceptance. Replacement parts must arrive within 5 business days after receipt of the failed parts. The Department does not pay for replacement parts. Deliver replacement parts to:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

86-3.11A(3) Testing

Comply with Section 86-2.17.

86-3.11A(4) Quality Control and Assurance

The Video Decoder and its associated firmware, software, hardware, protocols and other features must be fully compatible with the IP PTZ Camera installed on this project.

86-3.11B Materials

86-3.11B(1) General

Performance Requirements	
Description	Parameters
Decoding Support	1. D1 Resolution
	2. H.264
	3. MPEG Encoded Video, minimum rate of 30 fps
Output Format	1. Composite Analog NTSC Video
Streaming Methods	1. HTTP, RTSP/RTP, RTP Multicast, UDP Multicast and UDP Unicast.
	2. Port Mirroring

Provide an integrated web server for configuration and management functions.

Operational Requirements	
Description	Parameters
Input Video Format	H.264 MJPEG
Output Resolutions	NTSC 720x480 30 fps
IP Bitrate	256 Kbps to 20 Mbps minimum
Latency	Less than 500 milliseconds from Encoder

Protocol Requirements
1. Institute of Electrical and Electronics Engineers (IEEE) 802.3
2. Connection: RTST/RTP, HTTP Interleaved, HTTP Tunneling
3. Network Port: ICMP, RTP, RTSP, HTTP, IP, TCP/UDP, 10/100 Base TX, Auto Sensing

Provide Device Managing Software for configuration and access.

Physical Requirements	
Description	Parameter
Network Port Connector	RJ-45
Analog Video Interface	1. NTSC Resolution
	2. Composite Output
	3. BNC Connector
Input Voltage	120 VAC

Environmental Requirements	
Description	Parameter
Operating Temperature Range	From 0 to +55 °C
Relative Humidity	From 5 to 95 percent, non-condensing

86-3.11C Construction

The installation of the switch must be according to the plans and the manufacturer's instructions.

The Video Decoder must be mounted in a 19” rack. The placement of the Video Decoder must allow for provisions for cable installation and maintenance.

86-3.11D Payment

Not Used

Add to section 86-3.12:

86-3.12 HIGH BANDWIDTH WIRELESS ETHERNET RADIO

86-3.12A General

Section 86-3.12 includes specifications for furnishing and installing the High Bandwidth Wireless Ethernet Radio (HBWER)

86-3.12A(1) Summary

The HBWER is used for wireless communications between field elements and must provide a wireless Ethernet communication link to field elements.

86-3.12A(2) Submittals

Specifications of all cable assemblies, including connectors with strain relief backshells, must be submitted to the Engineer as part of the shop drawings for review and approval.

86-3.12A(3) Warranty

Furnish a 5 year replacement warranty from the manufacturer against any defects in materials or workmanship. The effective date of the warranty is the date of contract acceptance. Replacement parts must arrive within 5 business days after receipt of the failed parts. The Department does not pay for replacement parts. Deliver replacement parts to:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

86-3.12A(4) Quality Control and Assurance

86-3.12A(4)(a) Acceptance Testing

Comply with Section 86-2.17.

The Contractor must test all cables for continuity and shorts or grounds. Tests on cables with connectors attached (connectorized) must be performed after installation.

The Contractor must carry out system integration testing to ensure that the interfaces and all interconnect wiring and cabling perform to the specified standards when used in operation with all other devices installed under the contract.

86-3.12B Materials

86-3.12B(1) General

Parameter	Specification
Frequency of Operation	5100 – 5900 MHz
Wireless Standard	802.11n MIMO (Multiple-Input Multiple-Output)
RF Data Rate	Support at least 300 Mbps
Ports	1 Ethernet
Integrated Antenna	Minimum 18 dBi
Receiver Sensitivity	Minimum -66dBm at 300Mbps
Data Encryption	WPA2
RF-Power	64mW (18 dBm) Minimum at 300 Mbps before Antenna
Ethernet	RJ-45, 10/100 BaseT IEEE 802.3 (or better)
Antenna Connector	Weather resistant connectors for external antennas-Optional with Integrated Antennas
Network Protocols	FTP, Multicast TCP, UDP, ARP, ICMP, DHCP, HTTP, SNMP, QOS, VLANs, STP, NTP Client, MAC Address Filtering, Port Blocking
Management	HTTP, HTTPS
Diagnostics	RSSI Remote diagnostics
Operating Modes	Point-to-Point, Point-to-Multipoint, Peer-to-Peer
Ethernet Interface	RJ-45, 10/100BaseT, IEEE 802.3 Ethernet compliant auto-sense, auto-negotiate (or better)
Operating Temperature	-30 to +60° C, IP66 Weather Rated
Input Voltage	POE or POE+

86-3.12B(2) HBWER Antenna

86-3.12B(2)(a) Omni Directional Antenna

The HBWER radio as specified includes an integrated Directional antenna. If the selected HBWER radio has external antenna connectors, then an Omni Directional antenna may be used with the approval of the Engineer. The Omni Directional antenna must meet the following minimum requirements:

Parameter	Specification
Form Factor	60” maximum height
Beam Width	Omni Directional
Frequency	5150-5850 MHz MIMO (Multiple-Input and Multiple-Output)
VSWR	2:1 or Less
Power	90 Watts maximum
Gain	12dbi
Cross-pol Isolation	20 dbm minimum
Impedance	50 ohm
Polarization	Dual-Linear
Connecting Cables	(< 3’) LMR 400 or better
Environmental	-30 to +60° C

86-3.12B(2)(b) Directional Antenna

The Directional Antenna must be integrated into HBWER assembly.

86-3.12B(3) HBWER Interconnect Wiring

The HBWER interconnect wiring consists of CAT 5E cables and must be installed as shown on the plans, as specified in these special provisions and as recommended by the manufacturer.

All connectors must be in accordance with the manufacturer’s recommendation. All connectors installed outside the enclosure must be weather proof and watertight. Weather proofing and water sealing must be included, provided and installed.

The Contractor must configure interconnect wiring and cabling at all locations shown on the project plans.

The antenna coaxial cables to be used for 5.7 GHz RF connections must be of 50 ohms impedance, low loss, flexible, rugged and UV resistant, and must have greater than 90 dB RF shielding. The coaxial cable must have a minimum bend radius of 1.6”. Attenuation must not exceed 35.5 dB /100 m.

86-3.12C Construction

The installation of the HBWER must be according to the plans and the manufacturer's instructions.

Interconnect cabling and wiring must run continuous from the source to destination without splices.

Three feet of slack must be provided for equipment movement. All cabling must be secured and protected from physical damage.

86-3.12D Payment

Not Used

Add to section 86-3.13:

86-3.13 WIRELESS ETHERNET RADIO

86-3.13A General

Section 86-3.13 includes specifications for furnishing and installing the Wireless Ethernet Radio (WER)

86-3.13A(1) Summary

The WER is used for wireless communications between field elements and must provide a wireless serial EIA-232 and Ethernet communication link to field elements. The WER must act as an EIA-232 and Ethernet gateway.

86-3.13A(2) Submittals

Specifications of all cable assemblies, including connectors with strain relief backshells, must be submitted to the Engineer as part of the shop drawings for review and approval.

86-3.13A(3) Warranty

Furnish a 5 year replacement warranty from the manufacturer against any defects in materials or workmanship. The effective date of the warranty is the date of contract acceptance. Replacement parts must arrive within 5 business days after receipt of the failed parts. The Department does not pay for replacement parts. Deliver replacement parts to:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

86-3.13A(4) Quality Control and Assurance

86-3.13A(4)(a) Acceptance Testing

Comply with Section 86-2.17.

The Contractor must test all cables for continuity and shorts or grounds. Tests on cables with connectors attached (connectorized) must be performed after installation.

The Contractor must carry out system integration testing to ensure that the interfaces and all interconnect wiring and cabling perform to the specified standards when used in operation with all other devices installed under the contract.

86-3.13B Materials

86-3.13B(1) General

Parameter	Specification
Frequency of Operation	902 – 928 MHz
Spread Spectrum	Frequency Hopping and DTS
Hopping Channels	50/Pattern
Error Detection	32bitCRC, ARQ
RF Data Rate	345kbps and 1.384Mbps
Ports	1 EIA-232 Serial Port 1 Ethernet
Serial Baud Rate	300 baud to 921 kbaud
Receiver Sensitivity	-97dBm at 1.384Mbps and -105dBm at 345kpbs
Data Encryption	128 bit AES upgradeable to optional 256 bit AES
RF-Power	100mW to 1W (20-30dBm) programmable in 1dB steps
System Gain	135dB system gain w/unity again antenna
Serial Ports	EIA-232: RxD, TxD, RTS, CTS, DCD, DSR, DTR
Serial Connectors	DB-9F or RJ45
Sleep Mode	Supported on EIA-232 and Remote Wake up
Antenna Connector	Reverse Polarity TNC Male-Weather resistant connectors for external antennas.
Network Protocols	FTP, Serial over IP, Multicast TCP, UDP, ARP, ICMP, DHCP, HTTP, SNMP Serial to IP conversion,
Management	Local Serial Port Console, Telnet, HTTP, HTTPS
Diagnostics	RSSI Remote diagnostics
Operating Modes	Point-to-Point, Point-to-Multipoint, Store Forward Repeater, Peer-to-Peer
Ethernet Interface	RJ-45, 10/100BaseT, IEEE 802.3 Ethernet compliant auto-sense, auto-negotiate
Operating Temperature	-40 to +85° C
Input Voltage	10-28 VDC; 115-230 VAC

Carrier Detect (CD) or Clear to Send (CTS) signal must be asserted 0.1s +/- 0.01s prior to data being transmitted and must be de-asserted 0.1s +/-0.01s after the last byte sequence is transmitted.

86-3.13B(2) WER Antenna

86-3.13B(2)(a) Omni Directional Antenna

The Omni Directional Antenna must be compatible with the WER.

Omni Directional Antenna must meet the following minimum requirements:

Parameter	Specification
Form Factor	25” maximum height
Beam Width	Omni Directional
Frequency	902-928 MHz
VSWR	1.5:1 or Less
Power	150 Watts maximum
Gain	8dbm
Impedance	50 ohm
Connector	N-type Female
Environmental	-40 to +70° C

86-3.13B(2)(b) Directional Antenna

The Directional Antenna must be compatible with the WER.

The Directional Antenna must meet the following minimum requirements:

Parameter	Specification
Bandwidth	>70 MHz auto-negotiate
Beam Width	65° Horizontal / 55° Vertical
Polarization	Vertical / Horizontal
Radiation	Directional
Frequency	902-928 MHz
VSWR	1.5:1 or Less
Power	300 Watts max
Gain	6dBd
Lightning Protection	DC Ground
Wind Velocity	>100MPH
Impedance	50 ohm
Feed Connection	Reverse Polarity TNC (N-Female)
Maximum Length	41.5 in
Mounting	For both Polarizations
Environmental	-40 to +70° C

86-3.13B(3) WER Interconnect Wiring

The WER interconnect wiring consists of the coaxial and CAT 5E cables and must be installed as shown on the plans, as specified in these special provisions and as recommended by the manufacturer.

All connectors must be in accordance with the manufacturer’s recommendation. All connectors installed outside the enclosure must be weather proof and watertight. Weather proofing and water sealing must be included, provided and installed.

The Contractor must configure interconnect wiring and cabling at all locations shown on the project plans.

The antenna coaxial cables to be used for 900 MHz RF connections must be of 50 ohms impedance, low loss, flexible, rugged and UV resistant, and must have greater than 90 dB RF shielding. The coaxial cable must have a minimum bend radius of 1.6". Attenuation for 900 MHz must not exceed 15 dB /100 m.

86-3.13C Construction

The installation of the WER must be according to the plans and the manufacturer's instructions.

Interconnect cabling and wiring must run continuous from the source to destination without splices.

Three feet of slack must be provided for equipment movement. All cabling must be secured and protected from physical damage.

86-3.13D Payment

Not Used

Add to section 86-3.14:

86-3.14 ETHERNET EXTENDER

86-3.14A General

Section 86-3.14 includes specifications for furnishing and installing the Ethernet Extender (EE).

86-3.14A(1) Summary

The Ethernet extender (EE) must provide a managed secure Mbps point to point Ethernet connection.

86-3.14A(2) Warranty

Furnish a 5 year replacement warranty from the manufacturer against any defects in materials or workmanship. The effective date of the warranty is the date of contract acceptance. Replacement parts must arrive within 5 business days after receipt of the failed parts. The Department does not pay for replacement parts. Deliver replacement parts to:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

86-3.14A(3) Testing

Comply with Section 86-2.17.

86-3.14B Materials

86-3.14B(1) General

Port Requirements	
Description	Parameter
Ethernet Port	Support Auto MDIX10/100 Mbps, Full/Half Duplex Mode, Auto Negotiation Speed
Console Port	EIA232
Extender Port	RJ45 VDSL2

Standards Requirements
1. 802.3 (10Base-T)
2. 802.3u (100Base-TX)
3. 802.3x Flow Control
4. 802.1p for Class of Service
5. Ethernet over VDSL2

Protocol Requirements
1. SNMPv1/v2c/v3
2. TFTP
3. SNTP
4. HTTP
5. Telnet
6. LLDP
7. MIB-II

Minimum LED Status Indications
Power Status
Link Activity 10/100TX
Fault

Power Requirements
External Switching Power Adapter
Input Voltage 12 to 30 VDC

Environmental Requirements	
Description	Parameter
Operating Temperature Range	From -40 to +167 ℉
Relative Humidity	From 5 to 95 percent, Non-condensing

Regulatory Approvals	
Description	Parameters
EMI	1. FCC Part 15 Class A
	2. EN 55022 Class A
EMS	1. EN61000-4-2
	2. EN61000-4-3
	3. EN61000-4-4
	4. EN61000-4-5
	5. EN61000-4-6
	6. EN61000-4-8

Mechanical Requirements
Metal Case
IP30 Rated
DIN Rail Mount

86-3.14C Construction

The installation of the EEmust be according to the plans and the manufacturer's instructions.

The placement of the EE must allow for provisions for cable installation and maintenance.

86-3.14D Payment

Not Used

Add to section 86-3.16:

86-3.16 Multiple Outlet Power Strip

86-3.16A General

Section 86-3.16 includes specifications for furnishing and installing the Multiple Outlet Power Strip

86-3.16A(1) Summary

A Multiple Outlet Power Strip must be furnished and installed in the existing racks and cabinets as shown on the plans.

86-3.16A(2) Warranty

Furnish a 5 year replacement warranty from the manufacturer against any defects in materials or workmanship. The effective date of the warranty is the date of contract acceptance. Replacement parts must arrive within 5 business days after receipt of the failed parts. The Department does not pay for replacement parts. Deliver replacement parts to:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

86-3.16BMaterials

86-3.16B(1)General

Minimum Specifications:

Description	Parameters
Mounting	19” rack mount
Number of outlets	8 or greater NEMA 5-15R
Electrical Rating	15 A, 125 VAC, 60 Hz
Circuit Breaker	12 A, 125 VAC Minimum
Max. Surge Current	>6500 A
Max. Energy Dissipation	>210 J
Max. Energy Dissipation	Hot-to-Neutral
Clamping Response Time	Less than one nanosecond
Modes of Noise Protection	Transverse and Common
Noise Attenuation	20 to 40 dB
Noise Frequency Range	150 kHz - 100 MHz
Type of Cordset	SJT 14/3, NEMA 5-15P

86-3.16C Construction

The installation of the Multiple Outlet Power Strip must be according to the plans and the manufacturer's instructions.

The placement of the Multiple Outlet Power Strip must allow for provisions for cable installation and maintenance.

86-3.16D Payment

Not Used

Add to section 86-3.17:

86-3.17 POE POWER SUPPLY

86-3.17A General

Section 86-3.17 includes specifications for furnishing and installing the POE Power Supply.

86-3.17A(1) Summary

A POE Power Supply must be furnished and installed as shown on the plans or when required for existing POE injectors no longer operated by a Photovoltaic Power supply.

86-3.17A(2) Warranty

86-3.17B Materials

86-3.17B(1) General

Minimum Specifications:

Description	Parameters
Input Voltage	120 V AC
Output Voltage	12 V DC
Minimum Output Current	1 A,
Output Plug	Standard 2.5mm Coaxial DC plug (2.5mm x 5.5mm x 10mm Center Positive)

86-3.17C Construction

The installation of the POE Power Supply must be according to the plans.

The placement of the POE Power Supply must allow for provisions for cable installation and maintenance.

86-3.17D Payment

Not Used

Add to section 86-5:

86-5.04VEHICLE SENSOR NODES REPLACEMENT

86-5.04A General

86-5.04A(1) Summary

Section 86-5.03 includes specifications for replacing vehicle sensor nodes in the roadway.

86-5.04A(2) Definitions

AP: wireless access point.

FCC: Federal Communications Commission.

RP: wireless repeater

TIA: Telecommunications Industry Association.

VSN: Vehicle Sensor Node.

WVDS: wireless vehicle detector system.

86-5.04A(3) Submittals

Submit the following:

1. Documentation that defines the VSN's communication protocol (message structure organization, data packet length as well as information necessary to make use of such messages).
2. Software to configure VSN with the AP and RP and store and retrieve detection data and for the performance analysis at each site and also the software updates from the manufacturer during warranty period. The Department does not pay for software and software updates.
3. Documentation used to configure the VSN with the AP and RP and to store and retrieve detection data.
4. Documentation required for maintenance and operation of the VSN.
5. The original recording medium and documentation that supports the accuracy analysis of VSN. Submit an additional copy of this documentation for maintenance and operation.
6. Recorded medium and other materials at the conclusion of the performance test.
7. Warranty documentation before installation.

86-5.04A(4) Quality Control and Assurance

86-5.04A(4)(i) Functional Capabilities

The wireless communications link between the VSN and WVDS, RP, and AP must comply with FCC rules.

The communication protocol must be open and freely available for use in the public domain.

The VSN must be reconfigurable over the wireless interface and capable to avoid interference from other users of the communication band during reconfiguration.

The link budget must be 93 dB or more.

The VSN must respond within 100 seconds after associated AP is powered on.

The VSN system must provide the following measurements per lane:

1. Vehicle count in a data collection interval in units of vehicles.
2. Percent occupancy in a data collection interval in units of 0.05 percent.
3. Vehicle speed. If more than one VSN installed per lane:
   - 3.1. Per vehicle in units of mph.
   - 3.2. Mean speed in a data collection interval in units of mph.
   - 3.3. Distribution of vehicle speeds in a data collection interval in bins of <30 mph, 30-34 mph, 35-39 mph, 75-79 mph, and 80 or more mph in units of vehicles.
4. Vehicle length if more than one VSN installed per lane:
   - 4.1. Per vehicle in units of 0.1 feet.
   - 4.2. Distribution of vehicles length in a data collection interval in bins of <20.0 feet, 20.0-39.9 feet, 40.0-59.9 feet, and 60 or more feet in units of vehicles.

The time interval for data collection must be user-selectable at a minimum of 30-seconds intervals. The time interval for reporting must be user-selectable from a list containing at minimum, 30 seconds, 1 minute, 5 minutes, 15 minutes, 1 hour, and 24 hours.

Each VSN must have the following programmable event reporting parameters:

1. Transmit interval from a minimum value of 6 seconds.
2. Reporting latency from a minimum range of 6 to 30 seconds.
3. Vehicle presence pulse modes.
4. RF watchdog timer.
5. Synchronize event reporting to AP clock or to detection events.
6. Speed Trap measurement/time interval between 2 consecutive VSNs.

Each VSN must be individually addressable with a unique identifier, and capable of transmitting to the AP. Each VSN must also be capable of receiving detector parameters, microprocessor firmware and other commands from the AP without loss of data.

Each VSN must have the following programmable detection parameters:

1. Onset sensitivity and delay
2. Off sensitivity
3. Holdover time
4. Adaptable orientation
5. Auto recalibration timeout within 5 minutes in the event of a detector lock

The VSN must have the capability of outputting the state of each detection 1 or 0 in real time in sync with each vehicle passage event for the traffic. This data must be available electronically via the TIA/EIA-232 or TIA/EIA-485 or Ethernet communication port in a well documented format.

86-5.03A(4)(ii) Acceptance Testing

Quality assurance test and demonstration must start at a date and time specified by the Engineer.

Notify the Engineer 15 working days before the location is ready for acceptance testing.

Conduct acceptance testing during a normal work day between the hours of 0800 and 1600. Demonstrate the operation of all VSN units satisfying the functional requirements. The Engineer has the right to reject the VSNs, if the demonstration fails.

Verify accuracy by comparing the VSN vehicle counts to recorded video image counts for the same period.

Accuracy testing must be done at 5 percent of the VSN locations as selected by the Engineer.

Provide clear and visible recorded video images for at least one peak period for all lanes that the VSN was installed in. The recorded video images must show the viewed detection scene, detectors operation, and the vehicle traffic count.

Time-stamp to 1/100 of a second must be made available so that the data can be overlaid on the recorded video. Transfer the 6-hour analysis periods and associated time synced data to a DVD for viewing on a PC.

Provide a means for synchronizing the test start and end times or provide software that displays time stamped VSN data along with the video images of the moving vehicles.

The following video recording and analysis options that depend on the available traffic conditions are acceptable; however the heaviest expected traffic conditions should be used, if possible. The minimum analysis period must be:

1. 30 minutes when the recording includes congested traffic (vehicles traveling at less than 20 mph for 5 or more minutes in any lane).
2. 45 minutes when the traffic flow exceeds 1500 vehicles per hour in any lane during the test period.
3. 60 minutes when the flow is less than 1500 vehicles per hour in every lane.
4. The analysis must be based on a minimum of 500 detected vehicles in every lane and cover the same time period for all lanes. The time periods within the selected video will be selected by the Engineer. The total vehicle count for every lane must be used and include the first and last partial vehicles for each lane.

Errors in the start and finish of the VSN and manual counts are included in the performance criterion as specified. Each real vehicle in the video should be identified as ether detected correctly (DC), missed, (M), or over counted (OC).

VSN unit count must be compared to vehicle counts under traffic conditions specified above. The data accuracy must be determined by the formula:

Accuracy (Absolute Value) = 100{1- (TC-VC)/TC)}

where TC = Traffic Count derived from the media recording and
VC = VSN reported count over the same period of time.

Average overall accuracy must be greater than 95 percent across all lanes. Minimum accuracy for each time period must be greater than 90 percent per lane. The Engineer will review the results from the acceptance testing and accept or reject the results within 7 days. The Engineer determines any vehicle anomalies or unusual occurrences. Data or counts that are not agreed upon are considered errors and count against the unit's calibration. If the Engineer rejects the VSN performance analysis, you have seven days to re-calibrate and re-test the unit and re-submit new test data. Following three failed attempts, you must replace the VSN system with a new unit.

86-5.04A(4)(iii) Warranty

Furnish a 2-year replacement warranty including software updates from the manufacturer of the VSN components against any defects or failures. The effective date of the warranty is the date of installation. Furnish replacement VSN components within 10 days after receipt of the failed parts. The Department does not pay for the replacement or for software updates. Deliver replacement VSN components and software updates to the following department maintenance electrical shop:

District 8 – Inland Empire TMC
13892 Victoria Street
Fontana, CA 92336

86-5.04B Materials

86-5.04B(1) General

The VSN replacement includes VSN, epoxy sealant, testing, calibration with the existing WVDS and salvaging the existing VSN.

VSN components must be manufactured by Sensys Networks, Incorporated, 2560 Ninth Street, Suite 219, Berkeley, CA 94710, telephone (510) 548-4620.

VSN components must be new. The manufacturing date of VSN components as shown by date codes or serial numbers of electronic circuit assemblies must be within 6 months from the date of installation.

Prices for components not including taxes or shipping are:

Part Number	Description	Quantity					
		1-99	100-499	500-999	1000-1499	1500-2999	3000+
900-240-100-0-000	VSN240F Flush Mount Sensor	$457	$448	$425	$402	$379	$349
900-240-100-0-005	Epoxy sealant for sensor	$68	$67	$64	$60	$57	$52
--	Clear Plastic Shell for Sensor	$7.50	$7.50	$7.50	$7.50	$7.50	$7.50

The above prices are accurate for orders placed before December 31, 2016 if delivery is accepted within 90 days from order date.

86-5.04B(2) Vehicle Sensor Node

Each VSN consists of a magnetometer sensor, a microprocessor with firmware in non-volatile memory, a wireless transceiver, and a battery in a single housing.

The housing must be fully encapsulated and provide normal life of 8 years of operation over a temperature range of -34 to 165 degrees F. The housing must fit in a cylindrical hole no larger than 4.00 inches in diameter and 3.00 inches deep.

86-5.04B(3) Sealant

The sealant for VSN installation must be a self-leveling joint sealant and must be applied at a minimum temperature of 32 degree F.

86-5.04C Construction

Remove existing VSN. Comply with section 14-11.10 'Disposal of Electrical Equipment Requiring Special Handling'.

Procure VSN components directly from manufacturer.

Provide the following:

1. All equipment, documentation, materials and special tools required for acceptance testing of the system.
2. All software required to program, reconfigure and support the VSN installed at the time of acceptance testing.
3. Arrange for manufacturer representative to be present during installation and calibration of VSN.

Comply with the manufacturer's instructions and these special provisions for the installation and materials used.

Before the installation of any VSN component:

1. Obtain the Engineer's approval for the exact location.
2. Demonstrate that components will operate independently and will not interfere with other components at any other site or other equipment in the vicinity.
3. Demonstrate that each VSN will be installed within range of its corresponding AP and is located with a 60-degree horizontal cone, measured from perpendicular.
4. Test all VSNs and demonstrate proper operation and communication between the VSN and the AP.

Keep the maximum distance between a VSN and the AP as follows:

AP mounting height	Maximum distance from VSN to AP
12 feet	75 feet
18 feet	105 feet
24 feet	150 feet

Clear the surface to be bonded and remove debris, moisture and anything else that interferes with the sealant bond.

Install new VSN in the roadway. Clean holes cored in the pavement and thoroughly dry before installing VSN. Do not allow residue resulting from core drilling to flow across shoulders or lanes occupied by traffic. Remove residue from the pavement surface by vacuuming or other approved method before any reside flows off of the pavement surface. Dispose of residue from core drilling. Backfill the cored pavement per manufacturer's instructions. Remove any excess epoxy sealant from the roadway without the use of solvents.

Reconfigure and demonstrate successful communication between each VSN, and the AP after installation of all components.

Program the VSN and include a minimum of 16 channels per location to avoid interference from other users of the communication band during reconfiguration.

Install and orient the video camera so that traffic is visible in all lanes. The video field of view must totally encompass the area in which vehicles are detected.

Verify the performance of each site. The accuracy of each site must be determined and documented so that each site may be approved or rejected separately. Failure to submit the recorded medium and materials at the conclusion of testing invalidates the test. The recorded medium serves as acceptance evidence and must not be used for calibration. The calibration must have been completed prior to testing and verification.

The department does not pay for repairing, replacing, and retesting of VSN components due to failure or rejection.

86-5.04D Payment

Not used.

Replace "Reserved" in section 86-6.10D with:

Model 500 changeable message sign (CMS) system consists of a Model 500 changeable message sign, a Model 170E controller assembly in a completely wired Model 334LC cabinet with the required wiring, and auxiliary equipment required to control the CMS described.

The Model 500 changeable message sign, wiring harnesses and Model 170E controller assembly including controller unit and completely wired cabinet, but without anchor bolts, is Department-furnished.

Install the sign assembly on the sign structure. Construct the controller cabinet foundation as shown for a Model 334LC cabinet, including furnishing and installing anchor bolts. Install the controller cabinet on the foundation and connect the field wiring to the terminal blocks in the sign assembly and in the controller cabinet.

Field conductors no. 12 and smaller must terminate with spade terminals. Field conductors no. 10 and larger must terminate in spade or ring terminals.

A listing of field conductor terminations in each Department-furnished CMS and controller cabinet will be furnished free of charge to you at the job site.

The foundation location for each controller cabinet will be determined by the Engineer. Distance between the cabinet and the CMS structure must be less than 250 feet.

The Department will maintain the sign assemblies.

^^^

REVISED STANDARD SPECIFICATIONS APPLICABLE TO THE 2010 EDITION OF THE STANDARD SPECIFICATIONS

REVISED STANDARD SPECIFICATIONS DATED 10-30-15

ORGANIZATION

Revised standard specifications 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*. A date under a main-section heading is the date of the latest revision to the section.

Each revision to the *Standard Specifications* begins with a revision clause that describes or introduces a revision to the *Standard Specifications*. For a revision clause that describes a revision, the date on the right above the clause is the publication date of the revision. For a revision clause that introduces a revision, the date on the right above a revised term, phrase, clause, paragraph, or section is the publication date of the revised term, phrase, clause, paragraph, or section. For a multiple-paragraph or multiple-section revision, the date on the right above a paragraph or section is the publication date of the paragraphs or sections that follow.

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*.

^^^

Replace "MSDS" in the 1st table in section 1-1.06 with:

10-17-14

MSDS[b]

Add to the 1st table in section 1-1.06:

10-30-15

LCS	Department's lane closure system
MPQP	*Material Plant Quality Program* published by the Department
POC	pedestrian overcrossing
QSD	qualified SWPPP developer
QSP	qualified SWPPP practitioner
SDS	safety data sheet
TRO	time-related overhead
WPC	water pollution control

Add to the notes of the 1st table in section 1-1.06:

10-17-14

[b]Interpret a reference to MSDS as a reference to SDS under 29 CFR 1910.1200.

06-20-12

Delete the abbreviation and its meaning for *UDBE* in the 1st table of section 1-1.06.

10-19-12

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.

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:

10-19-12

work

Replace "excusable delay" and its definition in section 1-1.07B with:

10-19-12

delay: Event that extends the completion of an activity.

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:

10-19-12

work

Add to section 1-1.07B:

10-30-15

abandon: Render unserviceable in place.

adjust: Raise or lower a facility to match a new grade line.

10-19-12

Contract time: Number of original working days as adjusted by any time adjustment.

06-20-12

Disadvantaged Business Enterprise: Disadvantaged Business Enterprise as defined in 49 CFR 26.5.

10-30-15

modify: Add to or subtract from an appurtenant part.

obliterate: Place an earth cover over or root, plow, pulverize, or scarify.

quality characteristic: Characteristic of a material that is measured to determine conformance with a given requirement.

reconstruct: Remove and disassemble and construct again at an existing or new location.

relocate: Remove and install or place in a new location.

remove: Remove and dispose of.

reset: Remove and install or place laterally at the same station location.

salvage: Remove, clean, and haul to a specified location.

Replace "PO BOX 911" in the District 3 mailing address in the table in section 1-1.08 with:

04-20-12

703 B ST

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

Replace "--" for the telephone number for the Office Engineer in the table in section 1-1.11 with:

02-27-15

(916) 227-6299

Add to the table in section 1-1.11:

10-30-15

MPQP	http://www.dot.ca.gov/manuals.htm	--	--

^^

2 BIDDING

04-10-15

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 RESERVED

02-27-15

2-1.04 CONTRACTOR REGISTRATION

No contractor or subcontractor may be listed on a bid proposal for a public works project (submitted on or after March 1, 2015) unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5 [with limited exceptions from this requirement for bid purposes only under Labor Code section 1771.1(a)].

02-21-14

2-1.05 RESERVED

10-17-14

2-1.06 BID DOCUMENTS

01-23-15

2-1.06A General

The *Bid* book includes bid forms and certifications. For an electronic bid, the *Bid* book includes forms not available through the electronic bidding service.

The *Notice to Bidders and Special Provisions* includes the *Notice to Bidders*, revised standard specifications, and special provisions.

The *Bid* book, including *Bid* book forms not available through the electronic bidding service, *Notice to Bidders and Special Provisions*, project plans, and any addenda to these documents may be accessed at the Bidders' Exchange website.

The *Standard Specifications* and *Standard Plans* may be viewed at the Bidders' Exchange website and may be purchased at the Publication Distribution Unit.

10-17-14

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, you may view them at the Contract Plans and Special Provisions link at the Bidders' Exchange website.

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. Notify the Department of apparent errors and patent ambiguities in the plans, specifications, and Bid Item List. Failure to do so may result in rejection of a bid or rescission of an award.

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

02-21-14

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.

02-27-15

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.).

For each subcontractor listed, the Subcontractor List form must show:

1. Business name and the location of its place of business.
2. California contractor license number for a non-federal-aid contract.
3. Public works contractor registration number
4. Portion of work it will perform. Show the portion of the work by:
   - 4.1. Bid item numbers for the subcontracted work
   - 4.2. Percentage of the subcontracted work for each bid item listed
   - 4.3. Description of the subcontracted work if the percentage of the bid item listed is less than 100 percent

02-21-14

2-1.11 RESERVED

01-23-15

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, which may include, but is not limited to:
>
> (1) Withholding monthly progress payments;
> (2) Assessing sanctions;
> (3) Liquidated damages; and/or
> (4) Disqualifying the contractor from future bidding as non-responsible.

Include this assurance in each subcontract you sign with a subcontractor.

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*.

The Department shows a goal for DBEs to comply with the DBE program objectives provided in 49 CFR 26.1.

Make work available to DBEs and select work parts consistent with available DBEs, including subcontractors, suppliers, service providers, and truckers.

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 at bid opening the DBE firm is certified as a DBE by the California Unified Certification Program and possess the work codes applicable to the type of work the firm will perform on the Contract.

Determine that selected DBEs perform a commercially useful function for the type of work the DBE will perform on the Contract as provided in 49 CFR 26.55(c)(1)–(4). Under 49 CFR 26.55(c)(1)–(4), the DBE must be responsible for the execution of a distinct element of work and must carry out its responsibility by actually performing, managing, and supervising the work.

All DBE participation will count toward the Department's federally-mandated statewide overall DBE goal.

Credit for materials or supplies you purchase from DBEs will be evaluated on a contract-by-contract basis and 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 is performing a commercially useful function. The Department uses the following factors in determining whether a DBE trucking company is performing a commercially useful function:

- The DBE must be responsible for the management and supervision of the entire trucking operation for which it is responsible on a particular contract, and there cannot be a contrived arrangement for the purpose of meeting DBE goals.
- The DBE must itself own and operate at least one fully licensed, insured, and operational truck used on the contract.
- The DBE receives credit for the total value of the transportation services it provides on the Contract using trucks it owns, insures, and operates using drivers it employs.
- The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the Contract.
- The DBE may lease trucks without drivers from a non-DBE truck leasing company. If the DBE leases trucks from a non-DBE truck leasing company and uses its own employees as drivers, it is entitled to credit for the total value of these hauling services.
- A lease must indicate that the DBE has exclusive use of and control over the truck. This does not preclude the leased truck from working for others during the term of the lease with the consent of the DBE, so long as the lease gives the DBE absolute priority for use of the leased truck. Leased trucks must display the name and identification number of the DBE.

[49 Fed Reg 59595 (10/2/14) (to be codified at 49 CFR 26.55(d)]

04-10-15

2-1.12B(2) DBE Commitment Submittal

Submit DBE information under section 2-1.33.

Submit a copy of the quote from each DBE shown on the DBE Commitment form that describes the type and dollar amount of work shown on the form. Submit a DBE Confirmation form for each DBE shown on the DBE Commitment form to establish that it will be participating in the Contract in the type and dollar amount of work shown on the form. If a DBE is participating as a joint venture partner, submit a copy of the joint venture agreement.

01-23-15

2-1.12B(3) DBE Good Faith Efforts Submittal

You can meet the DBE requirements by either documenting commitments to DBEs to meet the Contract goal or by documenting adequate good faith efforts to meet the Contract goal. An adequate good faith effort means that the bidder must show that it took all necessary and reasonable steps to achieve a DBE goal that, by their scope, intensity, and appropriateness to the objective, could reasonably be expected to meet the DBE goal.

If you have not met the DBE goal, complete and submit the DBE Good Faith Efforts Documentation form 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.

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.

Refer to 49 CFR 26 app A for guidance regarding evaluation of good faith efforts to meet the DBE goal.

The Department considers DBE commitments of other bidders in determining whether the low bidder made good faith efforts to meet the DBE goal.

02-21-14

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 the 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

02-27-15

2-1.33 BID DOCUMENT COMPLETION AND SUBMITTAL

2-1.33A General

Complete the forms in the *Bid* book.

Use the forms provided by the Department except as otherwise specified for a bidder's bond.

Do not fax forms except for the copies of forms with the public works contractor registration number submitted after the time of bid. Fax these copies to (916) 227-6282.

Submit the forms and copies of the forms to the Office Engineer.

Failure to submit the forms and information as specified may result in a nonresponsive bid.

If an agent other than the authorized corporate 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.

2-1.33B Electronic Bids

Section 2-1.33B applies to electronic bids.

For an electronic bid, complete and submit the electronic portion of the *Bid* book under the *Electronic Bidding Guide* at the Bidders' Exchange website and submit the paper forms as specified for a paper bid.

Your authorized digital signature is your confirmation of and agreement to all certifications and statements contained in the *Bid* book.

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.

2-1.33C Paper Bids

Section 2-1.33C applies to paper bids.

Submit your bid and any *Bid* book forms after you submit your bid:

1. Under sealed cover
2. Marked as a bid
3. Identifying the contract number and the bid opening date

2-1.33D Bid Form Submittal Schedules

2-1.33D(1) General

The *Bid* book includes forms specific to the contract. The deadlines for the submittal of the forms vary depending on the requirements of each contract. Determine the requirements of the contract and submit the forms based on the applicable schedule specified in section 2-1.33D.

Bid forms and information on the form that are due after the time of bid may be submitted at the time of bid.

2-1.33D(2) Federal-Aid Contracts

2-1.33D(2)(a) General

Section 2-1.33D(2) applies to a federal-aid contract.

04-10-15

2-1.33D(2)(b) Contracts with a DBE Goal

Section 2-1.33D(2)(b) applies if a DBE goal is shown on the *Notice to Bidders*.

Submit the bid forms according to the schedule shown in the following table:

Bid Form Submittal Schedule for a Federal-Aid Contract with a DBE Goal

Form	Submittal deadline
Bid to the Department of Transportation	Time of bid except for the public works contractor registration number
Copy of the Bid to the Department of Transportation as submitted at the time of bid with the public works contractor registration number	10 days after bid opening
Subcontractor List	Time of bid except for the public works contractor registration number
Copy of the Subcontractor List as submitted at the time of bid with the public works contractor registration number	10 days after bid opening
Small Business Status	Time of bid
Opt Out of Payment Adjustments for Price Index Fluctuations[a]	Time of bid
DBE Commitment	No later than 4 p.m. on the 4th business day after bid opening
DBE Confirmation	No later than 4 p.m. on the 4th business day after bid opening
DBE Good Faith Efforts Documentation	No later than 4 p.m. on the 4th business day after bid opening

[a]Submit only if you choose the option.

02-27-15

2-1.33D(2)(c) Contracts without a DBE Goal

Reserved

2-1.33D(2)(d)–2-1.33D(2)(h) Reserved

2-1.33D(3) Non-Federal-Aid Contracts

2-1.33D(3)(a) General

Section 2-1.33D(3) applies to non-federal-aid contracts.

2-1.33D(3)(b) Contracts with a DVBE Goal

Section 2-1.33D(3)(b) applies if a DVBE goal is shown on the *Notice to Bidders*.

Submit the bid forms according to the schedule shown in the following table:

Bid Form Submittal Schedule for a Non-Federal-Aid Contract with a DVBE Goal

Form	Submittal deadline
Bid to the Department of Transportation	Time of bid except for the public works contractor registration number for a joint-venture contract
For a joint-venture contract, copy of the Bid to the Department of Transportation as submitted at the time of bid with the public works contractor registration number	10 days after bid opening
Subcontractor List	Time of bid
Opt Out of Payment Adjustments for Price Index Fluctuations[a]	Time of bid
Certified DVBE Summary	No later than 4 p.m. on the 4th business day after bid opening
California Company Preference	Time of bid
Request for Small Business Preference or Non–Small Business Preference[a]	Time of bid
Certified Small Business Listing for the Non–Small Business Preference[a]	No later than 4 p.m. on the 2nd business day after bid opening

[a]Submit only if you choose the option or preference.

2-1.33D(3)(c) Contracts without a DVBE Goal

Reserved

2-1.33D(3)(d)–2-1.33D(3)(h) Reserved

2-1.33D(4)–2-1.33D(9) Reserved

02-21-14

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.

^^

3 CONTRACT AWARD AND EXECUTION

02-27-15

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.

Replace section 3-1.03 with:

02-27-15

3-1.03 CONTRACTOR REGISTRATION

No contractor or subcontractor may be awarded a contract for public work on a public works project (awarded on or after April 1, 2015) unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5.

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 3-1.12 with:

01-23-15

3-1.12 RESERVED

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.

01-23-15

Delete items 4 and 6 of the 2nd paragraph of section 3-1.18.

02-27-15

Delete the 3rd paragraph of section 3-1.18.

Replace "For all other contracts, the" in the 4th paragraph of section 3-1.18 with:

02-27-15

The

^^

4 SCOPE OF WORK

10-30-15

Replace the 2nd paragraph of section 4-1.13 with:

10-30-15

The Department does not require you to remove warning, regulatory, or guide signs before Contract acceptance.

^^

5 CONTROL OF WORK

10-30-15

Add between "million" and ", professionally" in the 3rd paragraph of section 5-1.09A:

10-19-12

and 100 or more working days

Add to the list in the 4th paragraph of section 5-1.09A:

10-19-12

9. Considering discussing with and involving all stakeholders in evaluating potential VECPs

Add to the end of item 1.1 in the list in the 7th paragraph of section 5-1.09A:

10-19-12

, including VECPs

Replace the 1st paragraph of section 5-1.09C with:

10-19-12

For a contract with a total bid over $10 million and 100 or more working days, training in partnering skills development is required.

10-19-12

Delete the 2nd paragraph of section 5-1.09C.

Replace "at least 2 representatives" in the 5th paragraph of section 5-1.09C with:

10-19-12

field supervisory personnel

Replace the 8th paragraph of section 5-1.13A with:

04-24-15

Each subcontractor must have an active and valid:

1. State contractor license with a classification appropriate for the work to be performed (Bus & Prof Code § 7000 et seq.)
2. Public works contractor registration number with the Department of Industrial Relations

Replace section 5-1.13B with:

01-23-15

5-1.13B Disadvantaged Business Enterprises

5-1.13B(1) General

Section 5-1.13B applies to a federal-aid contract.

Use each DBE as listed on the DBE Commitment form unless you receive authorization for a substitution. Ensure that all subcontracts and agreements with DBEs to supply labor or materials are performed under 49 CFR 26.

Maintain records, including:

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

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

Before the 15th day of each month for the previous month's work, submit:

1. Monthly DBE Trucking Verification form
2. Monthly DBE Payment form

If a DBE is decertified before completing its work, the DBE must notify you in writing of the decertification date. If a business becomes a certified DBE before completing its work, the business must notify you in writing of the certification date. Submit the notifications. Upon work completion, complete a Disadvantaged Business Enterprises (DBE) Certification Status Change form. Submit the form within 30 days of Contract acceptance.

Upon work completion, complete a Final Report – Utilization of Disadvantaged Business Enterprises (DBE), First-Tier Subcontractors form. Submit it within 30 days of Contract acceptance. The Department withholds $10,000 until the form is submitted. The Department releases the withhold upon submission of the completed form.

04-10-15

5-1.13B(2) Performance of Disadvantaged Business Enterprises

Section 5-1.13(B)(2) applies if a DBE goal is shown on the *Notice to Bidders*.

DBEs must perform work or supply materials as listed on the DBE Commitment form.

Do not terminate or substitute a listed DBE for convenience and perform the work with your own forces or those of an affiliate, a non-DBE firm, or another DBE firm or obtain materials from other sources without authorization from the Department.

The Department authorizes a request to use other forces or sources of materials if it shows any of the following justifications:

1. Listed DBE fails or refuses to execute a written contract based on the plans and specifications for the project.

2. You stipulated that a bond is a condition of executing the subcontract and the listed DBE fails to meet your bond requirements.
3. Work requires a contractor license and the listed DBE does not have a valid license under the Contractors License Law.
4. Listed DBE fails or refuses to perform the work or furnish the listed materials.
5. Listed DBE's work is unsatisfactory and not in compliance with the Contract.
6. Listed DBE is ineligible to work on the project because of suspension or debarment.
7. Listed DBE becomes bankrupt or insolvent.
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 under 49 CFR 26.53.

Notify the original DBE of your intent to use other forces or material sources and provide the reasons. Provide the DBE with 5 business 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

If the Department authorizes the termination or substitution of a listed DBE, make good faith efforts to find another DBE. The substitute DBE must (1) perform at least the same dollar amount of work as the original DBE under the Contract to the extent needed to meet the DBE goal and (2) be certified as a DBE with the work code applicable to the type of work the DBE will perform on the Contract at the time of your request for substitution. Submit your documentation of good faith efforts within 7 days of your request for authorization of the substitution. The Department may authorize a 7-day extension of this submittal period at your request. Refer to 49 CFR 26 app A for guidance regarding evaluation of good faith efforts to meet the DBE goal.

Unless the Department authorizes a request to terminate or substitute a listed DBE, the Department does not pay for work unless it is performed or supplied by the DBE listed on the DBE Commitment form. You may be subject to other sanctions under 49 CFR 26.

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.

Replace section 5-1.20E with:

05-30-14

5-1.20E Water Meter Charges

Section 5-1.20E applies if a bid item for water meter charges is shown on the Bid Item List. The charges are specified in a special provision for section 5-1.20E.

The local water authority will install the water meters.

The charges by the local water authority include:

1. Furnishing and installing each water meter
2. Connecting to the local water authority's main water line, including any required hot tap or tee
3. Furnishing and installing an extension pipe from the main water line to the water meter
4. Sterilizing the extension pipe

Make arrangements and pay the charges for the installation of the water meters.

If a charge is changed at the time of installation, the Department adjusts the lump sum price based on the difference between the specified charges and the changed charges.

Replace section 5-1.20F with:

05-30-14

5-1.20F Irrigation Water Service Charges

Reserved

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.

07-19-13

Delete the 1st sentence in the 10th paragraph of section 5-1.23B(2).

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 "working days" in the 1st paragraph of section 5-1.43E(1)(a) with:

10-19-12

original working days

Replace "settled" in the last paragraph of section 5-1.43E(1)(d) with:

04-10-15

resolved

Replace items 3.1 and 3.2 in the list in the paragraph of section 5-1.43E(3)(b) with:

04-24-15

3.1. One-time objection to the other's candidate without stating a reason
3.2. Objection to any of the other's subsequent candidates based on a specific breach of the candidate's responsibilities or qualifications under items 1 and 2 above

Add between "held" and "no later than" in the 2nd sentence of the 1st paragraph of section 5-1.43E(3)(e):

10-30-15

no sooner than 30 days and

^^

6 CONTROL OF MATERIALS

10-30-15

Add between "replacing" and "Department-furnished" in the 1st sentence in the last paragraph of section 6-2.03:

10-30-15

lost or damaged

Replace section 6-2.05C with:

04-19-13

6-2.05C Steel and Iron Materials

Steel and iron materials must be melted and manufactured in the United States except:

1. Foreign pig iron and processed, pelletized, and reduced iron ore may be used in the domestic production of the steel and iron materials
2. If the total combined cost of the materials does not exceed the greater of 0.1 percent of the total bid or $2,500, materials produced outside the United States may be used if authorized

10-24-15

Furnish steel and iron materials to be incorporated into the work with certificates of compliance and certified mill test reports. Mill test reports must indicate where the steel and iron were melted and manufactured.

04-19-13

All melting and manufacturing processes for these materials, including an application of a coating, must occur in the United States. Coating includes all processes that protect or enhance the value of the material to which the coating is applied.

Replace the 2nd paragraph of section 6-3.04 with:

10-30-15

Develop, implement, and maintain a QC program.

Prepare and maintain QC records, including:

1. Names and qualifications of:
   1.1. Samplers
   1.2. Testers
   1.3. Inspectors
2. Testing laboratories' identification and certifications
3. Testing equipment calibrations and certifications
4. Inspection reports
5. Sampling and testing records organized by date and type of material
6. Test results with comparison of quality characteristic requirements
7. Test results in relation to action and any suspension limits
8. Records of corrective actions and suspensions

Within 24 hours, notify the Engineer of any noncompliance identified by your QC program.

Allow the Department access to all QC records.

Submit QC test data and QC test results within 2 business days of test completion.

Add between the 1st and 2nd paragraphs of section 6-3.05A:

10-30-15

The Department may inspect, sample, and test materials for compliance with the Contract at any time.

The Department's independent assurance program is described in the Department's *Independent Assurance Manual: Procedures for Accreditation of Laboratories and Qualification of Testers*. For the manual, go to the METS website.

10-30-15

Delete "if they are available at the job site" from the 3rd paragraph of section 6-3.05A.

Replace "Precast concrete members specified section 11-2" in the table in section 6-3.05B with:

07-19-13

Precast concrete members specified as tier 1 or tier 2 in section 90-4.01D(1)

^^

7 LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

10-30-15

Replace "§§ 1727 and 1770–1815" in the 1st sentence of the 1st paragraph of section 7-1.02K(1) with:

02-27-15

§ 1720 et seq.

Replace "$50" in the 1st sentence in the 6th paragraph of section 7-1.02K(2) with:

07-19-13

$200

Replace "$25" in the 2nd sentence in the 13th paragraph of section 7-1.02K(3) with:

07-19-13

$100

05-30-14

Add between the 1st and 2nd sentences in the 2nd paragraph of section 7-1.02K(6)(b):

10-30-15

Shop drawings of protective systems for which the Construction Safety Orders require design by a registered professional engineer must be sealed and signed by an engineer who is registered as a civil engineer in the State.

Delete "water or" in the 9th paragraph of section 7-1.03.

Add to the end of the 10th paragraph of section 7-1.03:

10-30-15

Flagging must comply with section 12-1. The Department pays you for this work under section 12-1.04.

Add between the 1st and 2nd sentences of the 7th paragraph of section 7-1.04:

10-30-15

Flagging must comply with section 12-1. The Department pays you for this work under section 12-1.04.

Replace "20 days" in the 14th paragraph of section 7-1.04 with:

09-16-11

25 days

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.

10-30-15

Delete "lane" in the 2nd sentence in the 27th paragraph of section 7-1.04.

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 contacting 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.

^^

8 PROSECUTION AND PROGRESS

10-30-15

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

04-20-12

Delete the 4th paragraph of section 8-1.02C(1).

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.

04-20-12

Delete the last paragraph of section 8-1.02C(3)(a).

Replace section 8-1.02C(3)(b) with:

10-19-12

8-1.02C(3)(b) Reserved

04-20-12

Delete the 3rd paragraph of section 8-1.02C(5).

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:

10-19-12

work

Replace "Contract" in item 9 in the list in the 4th paragraph of section 8-1.02D(4) with:

10-19-12

work

Replace "Contract completion" in the 4th paragraph of section 8-1.02D(6) with:

10-19-12

work completion

Replace "Contract working days" in the 4th paragraph of section 8-1.02D(6) with:

10-19-12

original working days

04-20-12

Delete items 1.3 and 1.4 in the list in the 1st paragraph of section 8-1.02D(10).

Replace the last paragraph of section 8-1.04B with:

10-30-15

The Department does not adjust time for work performed before Contract approval.

Replace the 1st paragraph of section 8-1.05 with:

10-30-15

Contract time starts on the earlier of the following:

1. Day you start job site activities after Contract approval
2. Last day specified to start job site activities in section 8-1.04

Replace the 2nd paragraph of section 8-1.05 with:

10-19-12

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.

Replace the headings and paragraphs in section 8-1.06 with:

10-19-12

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.

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 smooth and unobstructed passageway through the work during the suspension and deduct the cost from payments. The Department does not make a time adjustment for the suspension.

Upon the Engineer's order of suspension, suspend work immediately. Resume work when ordered.

Replace the 1st sentence in the 1st paragraph of section 8-1.07B with:

10-19-12

For a critical delay, the Department may make a time adjustment.

Add to the end of section 8-1.07C:

10-30-15

The Department does not make a payment adjustment for overhead incurred during non–working days of additional construction seasons experienced by reason of delay.

Replace the 1st paragraph of section 8-1.07C with:

10-19-12

For an excusable delay that affects your costs, the Department may make a payment adjustment.

Replace "8-1.08B and 8-1.08C" in the 1st paragraph of section 8-1.10A with:

08-05-11

8-1.10B and 8-1.10C

Replace section 8-1.10D with:

10-19-12

8-1.10D Reserved

^^

9 PAYMENT

10-30-15

Add to the list in the 1st paragraph of section 9-1.03:

07-19-13

3. Any royalties and costs arising from patents, trademarks, and copyrights involved in the work

Replace item 1 in the 3rd paragraph of section 9-1.03 with:

01-18-13

1. Full compensation for all work involved in each bid item shown on the Bid Item List by the unit of measure shown for that bid item

Replace "10" in the last paragraph of section 9-1.03 with:

01-23-15

7

Replace "in" in the 3rd paragraph of section 9-1.04A with:

10-19-12

for

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

Replace the heading and the 1st paragraph of section 9-1.04D(3) with:

01-23-15

9-1.04D(3) Equipment Not On the Job Site and Not Required for Original Contract Work

For equipment not on the job site at the time required to perform work paid by force account and not required for original Contract work, the time paid is the time the equipment is operated to perform work paid by force account and the time to return the equipment to its source when the work paid by force account is completed.

Replace item 2 in the 3rd paragraph of section 9-1.04D(3) with:

01-23-15

2. Operated less than 4 hours is paid as 1/2 day

Replace section 9-1.04D(4) with:

01-23-15

9-1.04D(4) Equipment Not On the Job Site and Required for Original Contract Work

For equipment not on the job site at the time required to perform work paid by force account and required for original Contract work, the time paid is the time:

1. To move the equipment to the location of work paid by force account plus an equal amount of time to move the equipment to a location on the job site or its source when the work paid by force account is completed
2. Equipment is operated to perform work paid by force account

04-20-12

Delete ", Huntington Beach," in the 3rd paragraph of section 9-1.07A.

Replace the formula in section 9-1.07B(2) with:

04-20-12

$Qh = HMATT \times Xa$

Replace "weight of dry aggregate" in the definition of the variable *Xa* in section 9-1.07B(2) with:

04-20-12

total weight of HMA

Replace the formula in section 9-1.07B(3) with:

04-20-12

$Qrh = RHMATT \times 0.80 \times Xarb$

Replace "weight of dry aggregate" in the definition of the variable *Xarb* in section 9-1.07B(3) with:

04-20-12

total weight of rubberized HMA

Replace the heading of section 9-1.07B(4) with:

04-20-12

Hot Mix Asphalt with Modified Asphalt Binder

Add between "in" and "modified" in the introductory clause of section 9-1.07B(4):

04-20-12

HMA with

Replace the formula in section 9-1.07B(4) with:

04-20-12

$Qmh = MHMATT \times [(100 - Xam) / 100] \times Xmab$

Replace "weight of dry aggregate" in the definition of the variable *Xmab* in section 9-1.07B(4) with:

04-20-12

total weight of HMA

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 *Xta* 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.

Add to the end of the 2nd paragraph of section 9-1.16E(1):

10-30-15

except as specified in section 9-1.16E(3)

10-19-12

Delete "revised Contract" in item 1 of the 1st paragraph of section 9-1.16E(2).

Add to the end of the 1st sentence of the 1st paragraph of section 9-1.16E(3):

10-30-15

except as specified below for the failure to submit a document during the last estimate period

Add to the end of section 9-1.16E(3):

10-30-15

During the last estimate period, if you fail to submit a document as specified, the Department withholds $10,000 for each document. The Department returns the withhold within 30 days after receipt of the document.

Replace the 1st paragraph of section 9-1.16E(4) with:

10-30-15

The Department withholds payments to cover claims filed under Civ Code § 9000 et seq.

Replace "2014" in the 1st paragraph of section 9-1.16F with:

10-19-12

2020

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:

10-19-12

proposed

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.

^^^

1. Applying a dust palliative under section 18
2. Applying temporary soil stabilization under section 13-5
3. Managing material stockpiles under section 13-4.03C(3)

04-19-13

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

^^

11 QUALITY CONTROL AND ASSURANCE

10-30-15

Replace section 11-2 with:

07-19-13

11-2 RESERVED

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

07-19-13

Delete the 3rd sentence in the 5th paragraph of section 11-3.02C(3).

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.

07-19-13

Delete the 3rd paragraph of section 11-3.02D.

Replace the 1st sentence in the 4th paragraph of section 11-3.02D with:

07-19-13

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:

07-19-13

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:

07-19-13

3. Repairs not included in the welding QC plan

Replace the 1st sentence of the 4th paragraph of section 11-3.02G with:

07-19-13

Requests to perform 3rd-time excavations, repairs of cracks, or repairs not included in the welding QC plan must include an engineering evaluation.

Replace the 2nd and 3rd paragraphs in section 11-3.03B with:

10-30-15

The AISC Certification category for overhead sign structures is Bridge and Highway Metal Component (CPT) or Simple Steel Bridge Structures (SBR).

The AISC Certification category for pole structures is Bridge and Highway Metal Component (CPT) or Standard for Steel Building Structures (STD).

^^

12 TEMPORARY TRAFFIC CONTROL

10-30-15

Replace the 5th paragraph of section 12-3.01A(1) with:

05-30-14

Repair or replace traffic-handling equipment and devices damaged from any cause during the Contract, including repainting if necessary. The condition of temporary traffic control devices must comply with the current American Traffic Safety Services Association publication "Quality Guidelines for Temporary Traffic Control Devices and Features."

Replace the 1st paragraph of section 12-3.01A(4) with:

10-19-12

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 the 2nd and 3rd paragraphs of section 12-3.04B with:

10-30-15

Portable delineators must be a minimum of 36 inches in height. The vertical portion of portable delineators must be predominantly orange-colored. The posts must be not less than 3 inches in width or diameter. Retroreflectorization of portable delineators that have a height of less than 42 inches must be provided by two 3-inch-wide white bands placed a maximum of 2 inches from the top with a maximum of 6 inches between the bands. Retroreflectorization of portable delineators that have a height of 42 inches or more must be provided by four 4- to 6-inch-wide alternating orange and white stripes with the top stripe being orange.

Add between the 1st and 2nd paragraphs of section 12-3.06A(1):

10-30-15

Construction project funding signs must comply with section 12-2.

Replace "project" in the 3rd paragraph of section 12-3.07C with:

10-19-12

work

Replace the 1st sentence of the 5th paragraph of section 12-3.08C with:

10-30-15

Install a reflector on the top or face of the rail of each rail unit placed within 10 feet of a traffic lane.

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.

07-19-13

Delete the 12th paragraph of section 12-4.02A.

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.

10-30-15

If the Engineer orders you to remove a closure before the time designated in the authorized closure schedule, any delay caused by this order is an excusable delay.

07-19-13

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.

Add to the end of section 12-6.01:

10-30-15

A traffic control system for a closure includes the temporary traffic control devices described as part of the traffic control system. The temporary traffic control devices must comply with section 12-3.

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

^^

13 WATER POLLUTION CONTROL

05-15-15

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 the 3rd paragraph of section 13-3.01B(2)(c) with:

05-15-15

The SAP must identify the sample containers, preservation requirements, holding times, analytical method, and the laboratory certified under the Environmental Laboratory Accreditation Program of the State Water Resources Control Board. For a list of certified laboratories, go to the board's website.

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

04-19-13

Delete the 1st sentence in the 2nd paragraph of section 13-4.03C(3).

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

05-30-14

Delete the 7th paragraph of section 13-4.03C(3).

Replace the heading of section 13-4.03E(1) with:

05-30-14

General

05-30-14

Delete the 1st through 5th sentences in the 2nd paragraph of section 13-4.03E(1).

Replace the 1st sentence of the 1st paragraph of section 13-4.03E(3) with:

05-30-14

Limit vehicle and equipment cleaning or washing at the job site to that needed for safety and protection of the equipment and compliance with PLACs.

Replace the paragraph in section 13-4.04 with:

04-20-12

Not Used

Replace "20-7.02D(6)" in section 13-5.02C with:

07-19-13

20-5.03E

10-19-12

Delete "or stockpile" in the 3rd paragraph of section 13-5.02F.

Replace "20-7.03I(10)" in section 13-5.03C with:

07-19-13

20-5.03E(3)

Replace section 13-5.03F with:

04-20-12

13-5.03F Reserved

10-19-12

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.

Replace the 2nd sentence in the 1st paragraph of section 13-9.01A with:

10-19-12

You may use any of the following systems for temporary concrete washout:

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:

10-19-12

Retain and submit an informational submittal for records of disposed concrete waste.

10-19-12

Delete the 4th paragraph of section 13-9.01B.

10-19-12

Delete "if authorized" in the 1st sentence in the 1st paragraph of section 13-9.02A.

Replace "at least 3-inch" in the 3rd sentence in the 1st paragraph of section 13-9.02A with:

10-19-12

6-inch

^^

14 ENVIRONMENTAL STEWARDSHIP

05-15-15

Replace section 14-9.03 with:

05-30-14

14-9.03 RESERVED

Replace "California Department of Public Health (CDPH)" in the 2nd paragraph of section 14-11.02E(1) with:

05-15-15

State Water Resources Control Board

^^

15 EXISTING FACILITIES

10-30-15

Replace section 15-1.03D with:

07-19-13

15-1.03D Reserved

Replace "metal beam guard railing" in the 1st paragraph of section 15-2.01C with:

07-19-13

guardrail

Replace the paragraphs of section 15-2.02B(1) with:

07-19-13

Section 15-2.02B includes specifications for removing pavement, base, subbase, and subgrade.

If only a portion of the pavement is removed, saw-cut the outline of the removal area on a neat line and with a power-driven saw before removing.

For asphalt concrete pavement, saw cuts must be at least 2 inches deep unless otherwise described.

Replace section 15-2.02B(4)(b) with:

07-19-13

15-2.02B(4)(b) Reserved

Add to section 15-2.02B:

07-19-13

15-2.02B(5) Remove Concrete Pavement

15-2.02B(5)(a) General

Remove only the portion of pavement to be replaced or repaired during the same lane closure. If there is overlying material on the concrete pavement, remove it with the pavement.

Do not impact the surface within 18 inches of the pavement to remain in place. Use removal methods that do not damage the remaining pavement and base. Slab-lifting equipment must attach to the pavement.

Instead of disposing of removed concrete pavement by removing it from the job site, you may dispose of it under section 15-3.01.

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

10-30-15

Delete "using Department-furnished tags" in the 4th paragraph of section 15-2.03A(2)(a).

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

07-19-13

Delete the 5th paragraph of section 15-3.03.

Replace the paragraphs of section 15-3.04 with:

10-30-15

Not Used

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 2nd sentence of the 3rd paragraph of section 15-4.02C(1) with:

10-17-14

Paint exposed ends of the remaining reinforcement with 2 applications of organic zinc-rich primer as specified for painting exposed ends of prestressing steel in section 50-1.03B(3).

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.

04-19-13

Delete "and concrete expansion dams" in the 3rd paragraph of section 15-5.01C(4).

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.

10-19-12

Delete the 4th paragraph of section 15-5.05C.

Replace "51-1.03F(5)" in the 3rd paragraph of section 15-5.06C(1) with:

07-19-13

51-1.01D(4)(b)

Replace "51-1.03E(5)" in the 5th paragraph of section 15-5.06C(1) with:

10-19-12

51-1.03F(5)

10-19-12

Delete the 9th paragraph of section 15-5.06C(1).

04-19-13

Delete the 15th paragraph of section 15-5.06C(1).

Add between the 18th and 19th paragraphs of section 15-5.06C(1):

07-19-13

Texture the polyester concrete surface before gelling occurs by longitudinal tining under 51-1.03F(5)(b)(iii), except do not perform initial texturing.

Replace section 15-5.06C(2) with:

04-19-13

15-5.06C(2) Reserved

04-19-13

Delete the 3rd paragraph of section 15-5.06D.

Replace the 1st paragraph in section 15-5.07B(4) with:

10-19-12

Payment for furnishing dowels is not included in the payment for core and pressure grout dowel.

Replace section 15-5.09 with:

04-19-13

15-5.09 POLYESTER CONCRETE EXPANSION DAMS

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

^^^

2. Manufacturer's name
3. Polymer emulsion type if a synthetic polymer emulsion is used, including identification of:
   3.1. Individual components greater than 5 percent by volume in blends of polymers with different compositions
   3.2. Additives greater than 2 percent by volume
4. SDS
5. Proposed methods for applying products
6. Application rate per pass, total application rate, and residual application rate
7. Required weather conditions for application, including ambient and surface temperatures, wind conditions, and allowable period before expected precipitation
8. Drying time or curing time required before traffic is allowed on the treated surface

Submit the manufacturer's instructions for the material to be used.

Submit a certificate of compliance for the dust suppressant, dust control binders, and fibers.

For a dust suppressant, include with the certificate of compliance:

1. Test results verifying compliance with the quality characteristic requirements in section 18-1.01D. The results must be from a test conducted within 12 months before the date of the certificate of compliance.
2. Test results from a test conducted within 12 months before the date of the certificate of compliance verifying compliance with the following environmental requirements:
   2.1. Maximum constituent concentration levels
   2.2. Organic and inorganic requirements for:
      2.2.1. VOCs
      2.2.2. Semi-VOCs
      2.2.3. Synthetic precipitation leaching procedure
   2.3. Aquatic toxicity

18-1.01D Quality Control and Assurance

A dust suppressant or dust control binder must comply with US EPA requirements and RWQCB requirements for soil stabilizers.

A dust suppressant must be tested by either an ASTM- or AMRL-AASHTO-accredited laboratory for compliance with the specified quality characteristic requirements.

A dust suppressant must be tested by an EPA-accredited laboratory for environmental requirements. Liquid chemical treatments must be tested before dilution. Solid products must be mixed with water to a 25 percent concentration before testing. The constituent concentration for each dust suppressant must not exceed the maximum levels shown in the following table:

Maximum Constituent Concentration Levels

Constituent	Test method	Requirement maximum level (ppm)
Arsenic	EPA Method 200.7	5.0
Barium		100.0
Cadmium		0.2
Chromium		1.0
Copper		1.0
Lead		1.0
Mercury	EPA Method 245.1	0.05
Selenium	EPA Method 200.7	5.0
Zinc		10.0
Phosphorus	EPA Method 365.4	2500.0
Cyanide	EPA Method 335.4	0.2

A dust suppressant must comply with the requirements shown in the following table:

Organic and Inorganic Requirements

Quality characteristic	Test method	Requirement
VOCs	EPA Method 8260	Set by the CalEPA Air Resources Board and local air district
Semi-VOCs	EPA Method 8270	US EPA Target Compound List and Contract-required quantitation limits
Synthetic precipitation leaching procedure	EPA Method 1312	Set by the RWQCB

A dust suppressant must comply with the aquatic toxicity requirements shown in the following table:

Aquatic Toxicity Requirements

Quality characteristic	Test method	Requirement
Aquatic toxicity[a] (LC50 min, ppm)	ASTM E729 or EPA Method 600/4-90/027F and EPA Method 600/4-91/002	10
Aquatic toxicity[a] (rating)	ASTM E729 or EPA Method 600/4-90/027F and EPA Method 600/4-91/002	slightly toxic or better
Renewal toxicity[b] (LC50 min, ppm)	ASTM E1295	10
Renewal toxicity[b] (rating)	ASTM E1295	slightly toxic or better

[a]Using *Ceriodaphnia dubia* (water flea), *Oncorhynchus mykiss* (rainbow trout), *Pimephales promelas* (fathead minnow), and *Americamysis bahia* (mysid shrimp)
[b]Using *Ceriodaphnia dubia* (water flea)

18-1.02 MATERIALS

18-1.02A General

A dust suppressant or a control binder must be either (1) miscible in water or (2) a material that is directly applied to the surface without mixing with water.

18-1.02B Dust Suppressants

18-1.02B(1) General

A dust suppressant must be one of the following:

1. Petroleum-based organic product
2. Nonpetroleum-based organic product
3. Hygroscopic product
4. Synthetic polymer emulsion

18-1.02B(2) Petroleum-Based Organic Products

A petroleum-based organic dust suppressant must be an asphalt emulsion, petroleum resin, base oil, mineral oil, or synthetic fluid.

An asphalt emulsion must be Grade SS1h.

A petroleum resin must comply with the requirements shown in the following table:

Petroleum Resin Requirements

Quality characteristic	Test method	Requirement
Residue (min, %)	ASTM D6934	60
pH	ASTM D1429	4.0–7.0
sp gr at 16 °C (min)	ASTM D1298	1.00
Kinematic visc at 25 °C (min, Saybolt Furol seconds[a])	ASTM D2170	188
Flash point (min °C)	ASTM D92	205
Particle charge test	ASTM D7402	Positive

[a]Use ASTM D2161 to convert the mm^2/s value to Saybolt Furol seconds

A base or mineral oil must comply with the requirements shown in the following table:

Base and Mineral Oils Requirements

Quality characteristic	Test method	Requirement
Base and mineral oil content (min, %)	--	75
sp gr at 16 °C (min)	ASTM D1298	0.85–0.90
Brookfield absolute visc at 20 °C (max, cP)	ASTM D2196	250
Flash point (min, °C)	ASTM D93	150

A synthetic fluid must comply with 40 CFR 35 and the requirements shown in the following table:

Synthetic Fluids Requirements

Quality characteristic	Test method	Requirement
Synthetic fluid content (min, %)	--	75
sp gr at 16 °C (min)	ASTM D1298	0.85–0.90
Brookfield absolute visc at 20 °C (max, cP)	ASTM D2196	250
Flash point (min, °C)	ASTM D93	140

18-1.02B(3) Nonpetroleum-Based Organic Products

A nonpetroleum-based organic dust suppressant must be lignosulfonate, plant oil, or tall oil pitch rosin.

A lignosulfonate must comply with the requirements shown in the following table:

Lignosulfonate Requirements

Quality characteristic	Test method	Requirement
Lignin sulfonate content ready to use (min, %)	ASTM D4900	25
Residue total solids content (min %)	ASTM D4903 or D2834	52
Lignin sulfonate content of residue (min, %)	--	50
Reducing sugars content of residue (min, %)	ASTM D5896 or D6406	25
pH	ASTM D1293	6.0–9.0
sp gr (min)	ASTM D1429	1.20
Brookfield absolute visc at 25 °C (max, cP)	ASTM D2196	1,000

A plant oil must comply with the requirements shown in the following table:

Plant Oil Requirements

Quality characteristic	Test method	Requirement
Residue active solids content (min, %)	ASTM D4903	50
sp gr (min)	ASTM D1429	0.93
Brookfield absolute visc 25 °C (cP)	ASTM D2196	50–200
Flash point (min, °C)	ASTM D93	288

A tall oil pitch rosin must comply with the requirements shown in the following table:

Tall Oil Pitch Rosin Requirements

Quality characteristic	Test method	Requirement
Rosin acid content (min, %)	ASTM D1240	10
Residue active solids content (min, %)	ASTM D2834	45
pH	ASTM D1293	3.0–9.0
sp gr (min)	ASTM D1429	1.00
Brookfield absolute visc at 25 °C (cP)	ASTM D2196	50–200

18-1.02B(4) Hygroscopic Products

A hygroscopic dust suppressant must be calcium chloride, calcium chloride flake, or magnesium chloride.

Calcium chloride must comply with the requirements shown in the following table:

Calcium Chloride[a] Requirements

Quality characteristic	Test method	Requirement
Calcium chloride content (%)	ASTM E449	28–42
Total magnesium chloride (max, %)	ASTM E449	6.0
Total alkali chlorides as sodium chloride (max, %)	ASTM E449	6.0
Calcium hydroxide content (max, %)	ASTM E449	0.2
pH with 5 percent solution	ASTM D1293	7.0–9.0
sp gr	ASTM D1429	1.28–1.44

[a]ASTM D98 or AASHTO M144

Calcium chloride flake must comply with the requirements shown in the following table:

Calcium Chloride Flake[a] Requirements

Quality characteristic	Test method	Requirement
Calcium chloride content (min, %)	ASTM E449	75
Total magnesium as $MgCl_2$ (max, %)	ASTM E449	6.0
Total alkali chlorides as sodium chloride (max, %)	ASTM E449	6.0
Calcium hydroxide content (max, %)	ASTM E449	0.2
pH with 5 percent solution	ASTM D1293	7.0–9.0
Gradation percent passing	ASTM C136	
3/8–inch sieve		100
No. 4 sieve		80–100
No. 30 sieve		0–5

[a]ASTM D98 or AASHTO M144

Magnesium chloride must comply with the requirements shown in the following table:

Magnesium Chloride Requirements

Quality characteristic	Test method	Requirement
Magnesium chloride content (%)	ASTM D4691 or ASTM D511[a]	28–33
Sulfate content as magnesium sulfate (max, %)	ASTM D4691[a]	4.0
Potassium content as potassium chloride (max, %)	ASTM E449	0.5
Sodium chloride content (max, %)	ASTM E449	1.0
pH with 5% solution	ASTM D1293	7.0–9.0
sp gr	ASTM D1429	1.31 ± 0.02

[a]You may use another appropriate atomic absorption spectrophotometry method such as that in *Standard Methods for the Examination of Water and Waste Water* by APHA-AWWA-WPCF.

18-1.02B(5) Synthetic Polymer Emulsions

A synthetic polymer emulsion must comply with the requirements shown in the following table:

Synthetic Polymer Emulsion Requirements

Quality characteristic	Test method	Requirement
Residue active solids content (min, %)	ASTM D2834	40
pH	ASTM D1429	4.0–9.5
sp gr at 16 °C	ASTM D1298	1.00–1.15
Brookfield absolute visc (max, cP)	ASTM D2196	1,000
Polymer film tensile strength – dry (psi)	ASTM D412	500
Retained coagulum on no. 100 sieve (max, %)	ASTM D1417	0.1
Ash content (max, %)	ASTM D5040	2

18-1.02C Dust Control Binders

A dust control binder must comply with the specifications for a tackifier in section 21-1.02F except section 21-1.01 does not apply.

Fibers must comply with section 21-1.02E except section 21-1.01 does not apply.

18-1.03 CONSTRUCTION

18-1.03A General

Monitor dust conditions and apply a dust palliative for dust control as described and as ordered. Reapply the dust palliative at any time to control dust.

Apply a dust suppressant to:

1. Temporary haul roads
2. Construction staging, material storage, and layout areas
3. Compacted soil or AB roads or driveways
4. Paved surfaces

Apply a dust control binder to:

1. Rough–graded soils
2. Completed slopes
3. Soil stockpiles unless another practice is already used

Do not use a dust suppressant or dust control binder within 100 feet of a wetland or body of water.

18-1.03B Equipment

Apply dust suppressants that are miscible in water with either (1) a pressure-type water distributor truck equipped with a spray system or (2) a pressure-type asphalt distributor truck as specified in section 93-1.03C.

Apply dust suppressant flakes to the surface using a spreader or spinner disk.

Apply dust control binders with either (1) a pressure-type water distributor truck equipped with a spray system or (2) hydraulic spray equipment as specified for applying hydromulch in section 21-1.03E.

18-1.03C Mixing and Application Rates

Use the mix proportions and application rate for the corresponding dust suppressant as shown in the following table:

Dust Suppressant Application

Dust suppressant	Mix proportions	Application rate
Asphaltic emulsion, Grade SS1H	5 parts water to 1 part emulsion	0.20–1.0 gal/sq yd
Petroleum resin emulsion	5 parts water to 1 part emulsion	0.20–1.0 gal/sq yd
Base and mineral oil	Apply undiluted	0.30–0.35 gal/sq yd
Lignosulfonate	1 part water to 1 part concentrate	1.0 gal/sq yd
Plant oil	Apply undiluted	0.25–0.50 gal/sq yd
Tall oil pitch rosin	5 parts water to 1 part emulsion for clayey soil and 10 parts water to 1 part emulsion for sandy soil	0.30–1.0 gal/sq yd
Calcium chloride solution (hygroscopic)	Apply undiluted	0.20–0.35 gal/sq yd
Calcium chloride flakes (hygroscopic)	--	1.0–1.5 lb/sq yd
Magnesium chloride (hygroscopic)	Apply undiluted	0.30–0.50 gal/sq yd
Synthetic polymer emulsion	9 parts water to 1 part concentrate	0.50 gal/sq yd

Apply hygroscopic dust suppressants under the manufacturer's instructions.

Apply calcium chloride flakes to a moist surface.

Allow surfaces treated with a dust suppressant to cure before opening them to traffic. Adequate cure occurs when moisture is evaporated, sheen is gone, and tracking is nonextant.

Use the mix proportions and application rate for the corresponding dust control binder as shown in the following table:

Dust Control Binder Application

Dust control binder	Mix proportions	Application rate
Guar	11 to 15 lb per 1,000 gal of water	44–59 lb/acre
Psyllium	Enough water to allow for uniform slurry flow	80–200 lb/acre
Starch	Manufacturer's recommended mix proportions with water	150 lb/acre
Liquid acrylic copolymers and polymers[a]	10 parts water to 1 part polymer	1,175 gal/acre
Liquid methacrylate and acrylate polymers	Manufacturer's recommended mix proportions with water	20 gal/acre
Copolymers of sodium acrylates and acrylamides	Manufacturer's recommended mix proportions with water	3–10 lb/acre
Polyacrylamide and copolymer of acrylamide	10 lb per 1,000 gal of water	5 lb/acre
Hydrocolloid polymers	Manufacturer's recommended mix proportions with water	54–64 lb/acre

[a]Mix and handle the polymeric compound in a manner that will not cause foaming. You may add an antifoaming agent.

Do not allow stormwater runoff from polyacrylamide treated soils unless water passes through:

1. Sediment basin if the total drainage area is greater than or equal to 5 acres.
2. Sediment trap or a series of check dams if the total drainage area is less than 5 acres. Maximize the number of check dams used and space them evenly in the drainage channel such that sediment settlement is maximized.

You may add fibers to dust control binders at a rate of 2,000 lb/acre.

You may reapply dust palliatives at a reduced application rate if authorized.

18-1.04 PAYMENT

Not Used

^^

19 EARTHWORK

10-17-14

Replace "20-3.03B(4)" in the 2nd paragraph of section 19-1.01A with:

07-19-13

20-2.02C(2)

Replace the 3rd paragraph in section 19-2.01A with:

07-19-13

Pavement removal within the limits of roadway excavation must comply with section 15-2.02B.

07-19-13

Delete the 2nd paragraph in section 19-2.03A.

Add to the 2nd paragraph of section 19-2.03D:

10-17-14

Topsoil must comply with section 21.

Replace the 2nd paragraph of section 19-3.01A(2)(b) with:

07-01-11

For cofferdams on or affecting railroad property, allow 85 days for review.

Add to the list in the 1st paragraph of section 19-3.01A(2)(d):

01-20-12

9. Provisions for discontinuous rows of soil nails

Replace "sets" in the 3rd and 4th paragraphs of section 19-3.01A(2)(d) with:

04-19-13

copies

Add to section 19-3.01A(3)(b):

01-20-12

For soil nail walls, wall zones are specified in the special provisions.

For ground anchor walls, a wall zone is the entire wall unless otherwise specified in the special provisions.

01-20-12

Delete the 2nd sentence in the 4th paragraph of section 19-3.01A(3)(b).

Replace "90" in the paragraph of section 19-3.02G with:

01-18-13

90-1

Add to section 19-3.02:

07-19-13

19-3.02I Filter Fabric

Filter fabric must be Class A.

Replace the heading of section 19-3.03C with:

04-19-13

19-3.03B(4) Cofferdams

Replace the heading of section 19-3.03D with:

04-19-13

19-3.03B(5) Water Control and Foundation Treatment

Replace the 1st paragraph of section 19-3.03E(3) with:

01-20-12

Compact structure backfill behind lagging of soldier pile walls by hand tamping, mechanical compaction, or other authorized means.

Add to the end of section 19-3.03E(3):

07-19-13

If filter fabric is shown behind the lagging:

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:

01-20-12

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.

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.

01-18-13

3. Grout and shotcrete have cured for at least 72 hours.

01-20-12

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.

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

10-30-15

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

10-30-15

The Engineer performs a progress inspection:

1. Before cultivating work starts
2. During pressure testing of irrigation pipe on the supply side of control valves
3. During testing of low voltage conductors
4. During irrigation system functional tests
5. Before planting work starts
6. After completion of planting work

07-19-13

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

10-30-15

Unless there is a bid item for irrigation water service charges, the Department furnishes water if it is available from an existing Department-owned facility within the project limits or an irrigation system to be installed under the Contract.

07-19-13

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

05-30-14

3. Causing excess runoff

10-30-15

If water use calculations are provided as supplemental project information, water plants under the Model Water Efficient Landscape Ordinance, 23 CA Code of Regs § 490 et seq., and local water agency requirements.

05-30-14

Water plants at night unless otherwise authorized.

07-19-13

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

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6. Rain sensors
7. Remote control valves
8. Backflow preventers

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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

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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.

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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.

10-30-15

2. Marked "WATER" in cast-in letters not less than 1 inch high unless shown.

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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.

10-30-15

20-2.01B(8) Wye Strainers

Wye strainers, except those used for drip valve assemblies, must:

1. Have a cast iron or all bronze body
2. Have a removable stainless steel strainer screen with 40-mesh woven wire
3. Have a 20-mesh woven wire screen or perforated sheet with 0.045-inch-diameter holes when on a backflow preventer assembly
4. Be capable of withstanding a working pressure of 150 psi
5. Be equipped with a garden valve at the outlet

07-19-13

20-2.01C Construction

20-2.01C(1) General

05-30-14

Immediately shut off water to broken supply lines, valves, or sprinkler assemblies. Repair irrigation systems within 24 hours after a malfunction or damage occurs.

07-19-13

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

10-30-15

Trench and backfill under section 86-2.01.

07-19-13

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.

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20-2.01C(3) Pull Boxes

10-30-15

Install pull boxes under section 86-2.06 at the following locations:

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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.

10-30-15

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. In open areas, install signs on metal posts under section 82-3.

07-19-13

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.

10-30-15

Work performed on existing irrigation facilities must comply with section 15.

07-19-13

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.

10-30-15

20-2.02C(8) Remove Irrigation Facilities

Irrigation facilities to be removed that are more than 6 inches below the finished grade may be abandoned in place unless salvaging is specified or shown.

Immediately after disconnecting an existing irrigation facility to be removed or abandoned from an existing facility to remain, the remaining facility must be capped or plugged, or connected to a new or existing irrigation facility.

20-2.02C(9) Salvage Irrigation Facilities

Salvage irrigation facilities under section 15-2.03.

07-19-13

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.

10-30-15

20-2.03B(4) Backflow Preventer Enclosures

Each backflow preventer enclosure must:

1. Be Type 304 stainless steel
2. Have expanded metal side, end, and top panels fabricated from 9-gauge minimum-thickness sheet with openings of approximately 3/4 by 1-3/4 inches
3. Have expanded metal panels attached to the 3/16-inch-thick 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
4. Have lock guards with a minimum thickness of 12 gauge
5. Have hexagonal nuts and lock-type washers
6. Have padlock-clasp or latch-and-lock mechanism

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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

10-30-15

Perform field tests on control and neutral conductors. Field tests must comply with the specifications in section 86-2.14B.

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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

10-30-15

Control and neutral conductors must comply with the requirements in section 86-2.08.

Electrical conduit and fittings must comply with section 86.

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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. Of the size recommended by the manufacturer of the controllers to be installed
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

10-30-15

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.

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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

10-30-15

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

base station: Designated computer that collects data from a series of satellite controllers through a centralized server.

centralized server: Designated server that collects data from all base stations.

network communication: Identified means through which satellite controllers, base stations, and a centralized server communicate to one another, such as fiber optics, spread spectrum, and phone lines.

remote access device: Wireless device, such as an FCC-compliant radio remote, web-enabled smart phone, or wireless computer or tablet, used to communicate with satellite controllers from a remote location.

remote irrigation control system: Centralized water-management system that consists of:

1. Base station
2. Centralized server or web-based application
3. Satellite controllers
4. Remote access device

satellite controller: Irrigation controller that communicates directly to a base station or centralized server.

smart controller: Irrigation controller that estimates or measures depletion of available plant soil moisture in order to operate an irrigation system, replenishing water as needed while minimizing excess water use.

web-based application: Encrypted managing software that is coded in a browser-supported language and is executable via a common Internet web browser, such as Internet Explorer, Firefox, and Safari.

20-2.07A(3) Submittals

Submit a complete manufacturer's maintenance and operations manual for each type of installed controller as an informational submittal.

After the work 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-inch 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.

20-2.07A(4) Quality Control and Assurance

Provide training by a qualified person on the use and adjustment of the installed irrigation controllers at least 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 AC-powered irrigation controllers must operate on 120 V(ac), 60 Hz, and supply from 24 to 30 V(ac), 60 Hz for operating electrical remote control valves.

Concrete for the pad and foundation must be minor concrete except the cementitious material content of the concrete must be at least 463 lb/cu yd. 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 smart controller from a single manufacturer.
2. Be fully automatic and capable of operating a complete 30-day or longer irrigation program.
3. 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.
4. Have nonvolatile memory.
5. Have a watering time display on the face of the control panel.
6. 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.
7. Have a variable or incremental timing adjustment ranging from 1 to 360 minutes per station.
8. Be capable of operating at least 3 program schedules.
9. Be capable of having at least 4 start times per program schedule.
10. Have an output that can energize a pump start circuit or a remote control master valve.
11. Be protected by fuses and circuit breakers.
12. Display a program and station affected by a sensory alert without changing other watering schedules not affected by the alert.
13. Be capable of global manual and automatic seasonal adjustments to all valves in any given program.
14. Automatically change watering schedule based on evapotranspiration data provided by a local weather station or have an internal programmed default of historical evapotranspiration data for a given region.
15. Support a flow sensor, and a rain sensor or access to a weather station, and have automatic shut-off capability.
16. 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 20-2.07B(3).

Irrigation controllers not installed in enclosure cabinets must be weatherproof, constructed of fiberglass or metal and have a door lock with 2 keys provided.

A remote irrigation system must comply with the specifications for 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-secured 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 comply with section 86 and:

1. Be minimum 14-gauge Type 304 stainless steel.
2. Include a mounting panel. Fabricate mounting panels using any of the following materials:
   - 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 if 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 from 24 to 30 V(ac)
2. Wireless and FCC compliant

20-2.07C Construction

Finish the exposed top surface of concrete pad with a medium broom finish applied parallel to the long dimension.

Install electrical components for automatic irrigation systems under section 86-1.02.

Install irrigation controllers under the manufacturer's instructions.

If 2 or more irrigation controllers operate the same remote master control valve, 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 120-volt or higher electrical service is not included in the payment for any type of irrigation controller.

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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.

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Solvent-cemented fittings for schedule 40 plastic pipe supply line must be injection molded PVC, schedule 40, and comply with ASTM D2466.

Solvent-cemented fittings for class 315 plastic pipe supply line must be injection molded PVC, schedule 80, and comply with ASTM D1784 and ASTM D2467.

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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.

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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. Reuse water from waterline flushing for landscape irrigation if practicable.

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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

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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.

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.

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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.

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

10-30-15

Not Used

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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

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.

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11. Be bottom, angled, or straight inlet configuration.

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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

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All valves must be installed in a valve box with a cover except:

1. Check valves
2. Garden valves
3. Pressure regulating valves installed on backflow preventers

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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

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20-2.12–20-2.13 RESERVED

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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

10-30-15

Submit nursery invoices showing sizes, quantities, and botanical names of plants, including genus, species, and variety. Include lot numbers for plants grown from the same seed lot or cutting source.

07-19-13

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.

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

[a]Do not use containers made of biodegradable material.
[b]Grown in individual container cells.
[c]Bare 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 ± 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

10-30-15

Backfill material for the palm tree planting holes must be 100 percent commercial quality washed plaster sand.

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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

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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:

04-20-12

and bonded fiber matrix

04-20-12

Delete the last paragraph of section 21-1.02E.

Replace section 21-1.02F(2) with:

04-20-12

21-1.02F(2) Reserved

Replace "20-7.02D(1)" in the 1st paragraph of section 21-1.02H with:

07-19-13

20-3.01B(4)

Replace section 21-1.02J with:

04-20-12

21-1.02J Reserved

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

Replace the paragraph in section 21-1.02P with:

10-19-12

Fiber roll must be a premanufactured roll filled with rice or wheat straw, wood excelsior, or coconut fiber. Fiber roll must be covered with biodegradable jute, sisal, or coir fiber netting secured tightly at each end and must be one of the following:

1. 8 to 10 inches in diameter and at least 1.1 lb/ft
2. 10 to 12 inches in diameter and at least 3 lb/ft

Fiber roll must have a minimum functional longevity of 1 year.

Add between the 1st and 2nd paragraphs of section 21-1.03A:

01-18-13

Remove and dispose of trash, debris, and weeds in areas to receive erosion control materials.

Remove and dispose of loose rocks larger than 2-1/2 inches in maximum dimension unless otherwise authorized.

Protect the traveled way, sidewalks, lined drainage channels, and existing vegetation from overspray of hydraulically-applied material.

Replace section 21-1.03B with:

01-18-13

21-1.03B Reserved

Replace "3 passes" in item 2 in the list in the 2nd paragraph of section 21-1.03G with:

04-19-13

2 passes

Replace section 21-1.03I with:

04-20-12

21-1.03I Reserved

Add between the 4th and 5th paragraphs of section 21-1.03P:

10-19-12

If soil conditions do not permit driving the stakes into the soil, drill pilot holes to facilitate driving of the stakes.

01-18-13

Delete the 1st and 2nd sentences of the 3rd paragraph in section 21-1.04.

^^^

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:

Aggregate Grading

Sieve sizes	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
3. At a rate of 1 gal/150 sq ft for the first application
4. At a rate of 1 gal/200 sq ft for the second application. Within 4 days after the first application, clean the surface and apply the second application.

Immediately repair damage to the curing compound or LCB.

28-2.03G Surfaces Not Within Tolerance

Where LCB will be paved with concrete pavement, remove the base wherever the surface is higher than the grade established by the Engineer and replace it with LCB. Where LCB will not be paved with concrete pavement, remove the base wherever the surface is higher than 0.05 foot above the grade established by the Engineer and replace it with LCB. If authorized, grind the surface with either a diamond or carborundum blade to within tolerance. After grinding LCB to be paved with concrete pavement and after all free water has left the surface, clean foreign material and grinding residue from the surface. Apply curing compound to the ground area at a rate of approximately 1 gal/150 sq ft.

Where the surface of LCB is lower than 0.05 foot from the grade established by the Engineer, remove the base and replace it with LCB or, if authorized, fill low areas according to the pavement material as follows:

1. For HMA pavement, fill low areas with HMA that complies with the specifications for the lowest layer of pavement. Do not fill low areas concurrently with the paving operation.
2. For concrete pavement, fill low areas with pavement concrete concurrent with the paving operation.

28-2.04 PAYMENT

LCB is measured from the dimensions shown.

Replace section 28-3 with:

07-19-13

28-3 RAPID STRENGTH CONCRETE BASE

Reserved

Replace section 28-4 with:

07-19-13

28-4 LEAN CONCRETE BASE RAPID SETTING

Reserved

Replace section 28-5 with:

07-19-13

28-5 CONCRETE BASE

Reserved

Add to section 28:

07-19-13

28-6–28-14 RESERVED

28-15 REPLACE BASE

Reserved

^^^

Replace the introductory clause of the 2nd paragraph of section 29-1.03B with:

04-18-14

Equipment for spreading and compacting ATPB must comply with section 39-1.03B. Compact ATPB in 1 layer using one of the following methods:

Replace "3rd" in the 4th paragraph of section 29-1.03C with:

07-19-13

4th

^^

Replace section 30 with:

04-20-12

30 RECLAIMED PAVEMENTS

04-20-12

30-1 GENERAL

30-1.01 GENERAL

Section 30 includes specifications for reclaiming the pavement section and constructing a base.

30-2 FULL DEPTH RECLAIMED—FOAMED ASPHALT

Reserved

30-3–30-6 RESERVED

^^^^^^^^^^^^^^^^^^^

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:

07-19-13

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 prepaving 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

03-21-14

Flush coat includes applying a fog seal coat to the surface, followed by sand.

07-19-13

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 specifictions 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.

03-21-14

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.

07-19-13

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.

07-19-13

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

	Percentage passing			
Sieve sizes	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

03-21-14

The cleanness value determined under California Test 227 must be 80 or greater.

07-19-13

37-2.04B(3) Construction

Asphaltic emulsion must be applied within the application rate ranges shown in the following table:

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:

10-30-15

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
AASHTO 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

07-19-13

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.

03-21-14

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

07-19-13

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

	Percentage passing			
Sieve sizes	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

03-21-14

The cleanness value determined under California Test 227 must be 86 or greater.

07-19-13

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

10-30-15

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 binder seal coat consists of applying 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: Combination of ground or granulated high natural crumb rubber and 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

At least 5 business days before use, submit the permit issued by the local air district for asphalt rubber binder field blending equipment and application equipment. If an air quality permit is not required by the local air district for producing asphalt rubber binder, submit verification from the local air district that an air quality permit is not required.

At least 10 days before starting seal coat activities, submit the name of an authorized laboratory to perform QC testing for asphalt rubber binder. The authorized laboratory must comply with the Department's Independent Assurance Program.

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 a certified volume or weight slip for each delivery of asphalt rubber binder ingredients and asphalt rubber binder.

Submit SDS for each asphalt rubber binder ingredient and the asphalt rubber binder.

At least 15 days before use, submit:

1. Four 1 qt 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, include:
     - 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, include:
     - 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, include:
     - 3.3.1. Test results for the specified quality characteristics
     - 3.3.2. Minimum reaction time and temperature

Submit a certificate of compliance and accuracy verification of test results for viscometers.

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 binder seal coat work.

Submit viscosity rest results within 2 business days after testing.

Submit resilience and softening point test results within 3 business days after testing.

37-2.05B(1)(d) Quality Control and Assurance

37-2.05B(1)(d)(i) General

The equipment used in producing asphalt rubber binder and the equipment used in spreading asphalt rubber binder must be permitted for use by the local air district.

37-2.05B(1)(d)(ii) Quality Control

37-2.05B(1)(d)(ii)(A) General

Reserved

37-2.05B(1)(d)(ii)(B) Asphalt Modifier

Test asphalt modifier under the test methods and frequencies shown in the following table:

Asphalt Modifier for Asphalt Rubber Binder

Quality characteristic	Test method	Frequency
Viscosity	ASTM D445	1 per shipment
Flash point	ASTM D92	
Molecular analysis Asphaltenes Aromatics	ASTM D2007	1 per shipment

37-2.05B(1)(d)(ii)(C) Crumb Rubber Modifier

Sample and test scrap tire CRM and high natural CRM separately. Test CRM under the test methods and frequencies shown in the following table:

Crumb Rubber Modifier

Quality characteristic	Test method	Frequency
Scrap tire crumb rubber gradation	California Test 385	1 per 250 tons or 1 per project, whichever is greater
High natural crumb rubber gradation	California Test 385	1 per 250 tons or 1 per project, whichever is greater
Wire in CRM	California Test 385	1 per 10,000 lb
Fabric in CRM	California Test 385	
CRM particle length	--	
CRM specific gravity	California Test 208	
Natural rubber content in high natural crumb rubber	ASTM D297	1 per 3,400 lb

37-2.05B(1)(d)(ii)(D) Asphalt Rubber Binder

Test asphalt rubber binder under the test methods and frequencies shown in the following table:

Quality characteristic	Test method	Sampling location	Frequency
Descending viscosity[a]	ASTM D7741/D7741M	Reaction vessel	1 per lot[b]
Viscosity at 375 °F	ASTM D7741/D7741M	Distribution truck	15 minutes before use per lot[b]
Cone penetration	ASTM D217	Distribution truck	1 per lot[b]
Resilience	ASTM D5329		
Softening point	ASTM D36/D36M		

[a]Start taking viscosity readings 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 complies with the specification requirement.
[b]The lot is defined in the Department's *MPQP*.

Retain the sample from each lot. Test for cone penetration, resilience, and softening point for the first 3 lots and if all 3 lots pass, the testing frequency may be reduced to once for every 3 lots.

If QC test results indicate that the asphalt rubber binder does not meet the specifications, take corrective action and notify the Engineer.

37-2.05B(1)(d)(iii) Department Acceptance

37-2.05B(1)(d)(iii)(A) General

Reserved

37-2.05B(1)(d)(iii)(B) Crumb Rubber Modifier

The Department accepts CRM based on the gradation requirements shown in the following table when tested under California Test 385:

Crumb Rubber Modifier Gradation Requirements

Sieve size	Scrap tire crumb rubber		High natural crumb rubber	
	Operating range	Contract compliance	Operating range	Contract compliance
No. 8	100	100	--	--
No. 10	95–100	90–100	100	100
No. 16	35–85	32–88	92–100	85–100
No. 30	2–25	1–30	25–95	20–98
No. 50	0–10	0–15	6–35	2–40
No. 100	0–5	0–10	0–7	0–10
No. 200	0–2	0–5	0–3	0–5

If a test result for CRM gradation does not comply with the specifications, the Department deducts the corresponding amount for each gradation test as shown in the following table:

Material	Test result [a]	Deduction
Scrap tire crumb rubber	Operating range < TR < Contract compliance	$250
Scrap tire crumb rubber	TR > Contract compliance	$1,100
High natural crumb rubber	Operating range < TR < Contract compliance	$250
High natural crumb rubber	TR > Contract compliance	$600

[a] Test Result = TR

Each gradation test for scrap tire crumb rubber represents 10,000 lbs or the quantity used in that day's production, whichever is less.

Each gradation test for high natural crumb rubber represents 3,400 lbs or the quantity used in that day's production, whichever is less.

37-2.05B(1)(d)(iii)(C) Asphalt Rubber Binder

For Department acceptance testing, take a sample of asphalt rubber binder in the Engineer's presence every 5 lots or once a day, whichever is greater. Each sample must be in a 6 qt can with open top and friction lid.

The Department accepts asphalt rubber binder based on compliance with the requirements shown in the following table:

Quality characteristic	Test method	Requirement
Cone penetration at 25 °C (0.10 mm)	ASTM D217	25–60
Resilience at 25 °C (% rebound)	ASTM D5329	18–50
Softening point (°C)	ASTM D36/D36M	55–88
Viscosity at 375 °F (Pa•s x 10^{-3})[a]	ASTM D7741/D7741M	1,500–2,500

[a]Prepare sample for viscosity test under California Test 388.

37-2.05B(1)(d)(iii)(D) Precoated Screenings

The Department accepts precoated screenings based on compliance with the requirements shown in the following table:

Precoated Screenings Acceptance Criteria

Quality characteristic	Test method	Requirement		
Los Angeles Rattler Loss (max, %) Loss at 100 revolutions Loss at 500 revolutions	California Test 211	 10 40		
Film stripping (max, %)	California Test 302	25		
Cleanness value (min)	California Test 227	80		
Durability (min)	California Test 229	52		
Gradation (% passing by weight) Sieve sizes:	California Test 202	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

37-2.05B(2) Materials

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 comply with the requirements shown in the following table:

Asphalt Modifier for Asphalt Rubber Binder

Quality characteristic	Test method	Requirement
Viscosity at 100 °C ($m^2/s \times 10^{-6}$)	ASTM D445	X ± 3 [a]
Flash point (CL.O.C., °C)	ASTM D92	207 min
Molecular analysis Asphaltenes by mass (max, %) Aromatics by mass (min, %)	ASTM D2007	 0.1 55

[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

CRM 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 CRM particles must be large enough to be ground or granulated.

Wire must not be more than 0.01 percent by weight of CRM when tested under California Test 385. CRM must be free of contaminants except fabric, which must not exceed 0.05 percent by weight of CRM.

The length of an individual CRM particle must not exceed 3/16 inch.

CRM must be dry, free-flowing particles that do not stick together. A maximum of 3 percent calcium carbonate or talc by weight of CRM may be added. CRM must not cause foaming when combined with the asphalt binder and asphalt modifier.

Specific gravity of CRM must be from 1.1 to 1.2 determined under California Test 208.

The CRM must comply with the requirements shown in the following table:

Crumb Rubber Modifier Requirements

Quality characteristic	Test method	Requirement	
		Scrap tire crumb rubber	High natural crumb rubber
Acetone extract (%)	ASTM D297	6.0–16.0	4.0–16.0
Rubber hydrocarbon (%)	ASTM D297	42.0–65.0	50.0 min
Natural rubber content (%)	ASTM D297	22.0–39.0	40.0–48.0
Carbon black content (%)	ASTM D297	28.0–38.0	--
Ash content (%)	ASTM D297	8.0 min	--

When tested under California Test 385, scrap tire crumb rubber must comply with the gradation requirements 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

When tested under California Test 385, high natural crumb rubber must comply with the gradation requirements 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

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 CRM. The minimum percentage of CRM must be 20.0 percent and lower values may not be rounded up.

CRM must be 76 ± 2 percent by weight scrap tire crumb rubber and 24 ± 2 percent by weight high natural crumb 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 CRM may be proportioned and combined simultaneously.

The blend of asphalt binder and asphalt modifier must be combined with the CRM at the asphalt rubber binder production site. The asphalt binder and asphalt modifier blend must be from 375 to 440 degrees F when the CRM 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 comply with the requirements shown in the following table:

Quality characteristic	Test method	Requirement
Cone penetration at 25 °C (0.10 mm)	ASTM D217	25–60
Resilience at 25 °C (% rebound)	ASTM D5329	18–50
Softening point (°C)	ASTM D36/D36M	55–88
Viscosity at 375 °F (Pa•s x 10^{-3})[a]	ASTM D7741/D7741M	1,500–2,500

[a]Prepare sample for viscosity test under California Test 388.

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, screenings for asphalt rubber binder seal coat must comply with the gradation requirements shown in the following table:

Asphalt Rubber Binder Seal Coat Screenings Gradation

Percentage passing by weight		
Sieve sizes	Medium 1/2" max	Fine 3/8" max
3/4"	100	100
1/2"	85–90	95–100
3/8"	0–30	70–85
No. 4	0–5	0–15
No. 8	--	0–5
No. 200	0–1	0–1

The seal coat screenings must comply with the requirements shown in the following table:

Seal Coat Screenings

Quality characteristic	Test method	Requirement
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 gauges
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

Precoating of screenings must be performed at a central mixing plant. The plant must be authorized under the Department's Material Plant Quality Program.

For asphalt rubber binder 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 binder 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. The asphalt must be from 0.5 to 1.0 percent by weight of dry screenings. The Engineer determines the exact rate.

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. You may reduce the application rate by 0.050 gal/sq yd in the wheel paths.

Apply asphalt rubber binder when the ambient 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 enough screenings are available at the job site 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 pavement is damp or during high wind conditions. If authorized, you may adjust the distributor bar height and distribution speed and use shielding equipment during high wind conditions.

37-2.05B(3)(e) Screenings Application

During transit, cover precoated screenings for asphalt rubber binder 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 binder 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.

If authorized for final rolling, you may use a steel-wheeled roller weighing from 8 to 10 tons in static mode only.

Perform a final sweeping before Contract acceptance. The final sweeping must not dislodge screenings.

37-2.05B(4) Payment

The payment quantity for precoated screenings is the weight measured after the screenings are preheated and precoated with asphalt binder.

If recorded batch weights are printed automatically, the payment quantity for screenings is the weight determined from the printed batch weights if:

1. Total aggregate weight for the 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. Copy of the recorded batch weights is certified by a licensed weighmaster

Asphalt rubber binder is measured as specified for asphalt binder.

07-19-13

37-2.05C Modified Asphalt Binder Seal Coat

Reserved

03-21-14

37-2.06 STRESS ABSORBING MEMBRANE INTERLAYER

37-2.06A General

Section 37-2.06 applies where a stress absorbing membrane interlayer (SAMI) is shown.

Comply with section 37-2.05B except a flush coat is not required.

37-2.06B Materials

For SAMI, screenings must comply with the 3/8-inch maximum gradation.

37-2.06C Construction

For SAMI, section 37-2.01C(7) does not apply.

Final rolling and sweeping are not required for SAMI.

37-2.06D Payment

Not Used

37-2.07–37-2.10 RESERVED

Add to section 37-3.01D(1):

01-18-13

Micro-surfacing spreader operators must attend the prepaving conference.

^^

39 HOT MIX ASPHALT

10-30-15

Replace the headings and paragraphs in section 39 with:

04-18-14

39-1 GENERAL

39-1.01 GENERAL

39-1.01A Summary

Section 39-1 includes general specifications for producing and placing hot mix asphalt.

HMA includes one or more of the following types:

1. Type A HMA
2. RHMA-G
3. OGFC
4. BWC
5. Minor HMA

10-30-15

If the use of a warm mix asphalt technology is allowed or required by a special provision, the warm mix asphalt technology to be used must be on the Authorized Materials List for approved technologies.

Wherever reference is made to the following test methods, the year of publication for these test methods is as shown in the following table:

Test method	Year of publication
AASHTO M 17	2011 (2015)
AASHTO M 323	2013
AASHTO R 30	2002 (2015)
AASHTO R 35	2014
AASHTO R 56	2014
AASHTO R 57	2014
AASHTO T 27	2014
AASHTO T 49	2014
AASHTO T 59	2013
AASHTO T 96	2002 (2010)
AASHTO T 164	2014
AASHTO T 176	2008
AASHTO T 209	2012
AASHTO T 269	2014
AASHTO T 275	2007 (2012)
AASHTO T 283	2014
AASHTO T 304	2011
AASHTO T 305	2014
AASHTO T 308	2010
AASHTO T 312	2014
AASHTO T 324	2014
AASHTO T 329	2013
AASHTO T 335	2009
ASTM D36/D36M	$2014^{\varepsilon 1}$
ASTM D92	2012b
ASTM D217	2010
ASTM D297	2013
ASTM D445	2014
ASTM D2007	2011
ASTM D2074	2007 (Reapproved 2013)
ASTM D2995	1999 (Reapproved 2009)
ASTM D4791	2010
ASTM D5329	2009
ASTM D7741/D7741M	$2011^{\varepsilon 1}$

39-1.01B Definitions

binder replacement: Binder from RAP expressed as a percent of the total binder in the mix.

coarse aggregate: Aggregate retained on a no. 4 sieve.

fine aggregate: Aggregate passing the no. 4 sieve.

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.

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miscellaneous areas: Areas outside the traveled way and shoulders such as:

1. Median areas not including inside shoulders
2. Island areas
3. Sidewalks
4. Gutters
5. Ditches
6. Overside drains
7. Aprons at ends of drainage structures

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processed RAP: RAP that has been fractionated.

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supplemental fine aggregate: Mineral filler consisting of rock dust, slag dust, hydrated lime, hydraulic cement, or any combination of these and complying with AASHTO M 17.

04-18-14

39-1.01C Submittals

39-1.01C(1) General

Reserved

39-1.01C(2) Job Mix Formula

39-1.01C(2)(a) General

Except for the HMA to be used in miscellaneous areas and dikes, submit your proposed JMF for each type of HMA to be used. The JMF must be submitted on the Contractor Job Mix Formula Proposal form along with:

1. Mix design documentation on Contractor Hot Mix Asphalt Design Data form dated within 12 months of submittal
2. 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. Supplemental fine aggregate except fines from dust collectors
   - 4.3. Antistrip additives

The Contractor Hot Mix Asphalt Design Data form must show documentation on aggregate quality.

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.

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. Combined aggregate gradation
4. Aggregate sources
5. Liquid antistrip producer or dosage
6. Average binder content in a new fractionated RAP stockpile by more than ±2.00 percent from the average RAP binder content reported on page 4 of your Contractor Hot Mix Asphalt Design Data form
7. Average maximum specific gravity in a new fractionated RAP stockpile by more than ±0.060 from the average maximum specific gravity value reported on page 4 of your Contractor Hot Mix Asphalt Design Data form
8. Any material in the JMF

Allow the Engineer 5 business days from a complete JMF submittal for document review of the aggregate qualities, mix design, and JMF. The Engineer notifies you if the proposed JMF submittal is accepted.

10-30-15

If your JMF fails verification testing, submit an adjusted JMF based on your testing. The adjusted JMF must include a new Contractor Job Mix Formula Proposal form, Contractor Hot Mix Asphalt Design Data form, and the results of the failed verification testing.

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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.

39-1.01C(2)(b) 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

39-1.01C(2)(c) Job Mix Formula Modification

For an authorized JMF, submit a modified JMF if you change any of the following:

1. Asphalt binder supplier
2. Liquid antistrip producer
3. Liquid antistrip dosage

You may change any of the above items only once during the Contract.

Submit your modified JMF request a minimum of 15 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 authorized JMF to be modified.
3. JMF verification on Hot Mix Asphalt Verification form for the authorized JMF to be modified.
4. Test results for the modified JMF in compliance with the mix design specifications. 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 10 days of receiving all verification samples.

39-1.01C(3) 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. Taking samples, including sampling locations
3. Establishing, implementing, and maintaining QC
4. Determining when corrective actions are needed
5. Implementing corrective actions
6. Methods and materials for backfilling core locations

The QC plan 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 QC 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.

10-30-15

If QC procedures, personnel, or sample testing locations change, submit a QC plan supplement at least 3 business days before implementing the proposed change. Do not implement the change without authorization.

04-18-14

39-1.01C(4) Test Results

For 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

Submit all QC test results, except AASHTO T 283 and AASHTO T 324 (Modified), within 3 business days of a request. Submit AASHTO T 283 QC tests within 15 days of sampling.

For tests performed under AASHTO T 324 (Modified), submit test data and 1 tested sample set within 5 business days of sampling.

If coarse and fine durability index tests are required, submit test results within 2 business days of testing.

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If a tapered notched wedge is used, submit compaction test result values within 24 hours of testing.

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39-1.01C(5) Reserved

39-1.01C(6) Liquid Antistrip Treatment

If liquid antistrip treatment is used, submit the following with your proposed JMF submittal:

1. One 1-pint sample
2. Infrared analysis including copy of absorption spectra
3. Certified copy of test results
4. Certificate of compliance for each liquid antistrip shipment. On each certificate of compliance, include:
   - 4.1. Your signature and printed name
   - 4.2. Shipment number
   - 4.3. Material type
   - 4.4. Material specific gravity
   - 4.5. Refinery
   - 4.6. Consignee
   - 4.7. Destination
   - 4.8. Quantity
   - 4.9. Contact or purchase order number
   - 4.10. Shipment date
5. Proposed proportions for liquid antistrip

For each delivery of liquid antistrip to the HMA production plant, submit a 1-pint sample to METS. Submit shipping documents. Label each liquid antistrip sampling container with:

1. Liquid antistrip 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 HMA mixing plant type, submit the following information in the order specified:

1. For batch plant 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. Liquid antistrip content as a percentage of the asphalt binder weight
2. For continuous mixing plant:
   - 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 liquid antistrip collected from the liquid antistrip 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. Liquid antistrip content as percentage of the asphalt binder weight calculated from:
    2.9.1. Asphalt binder meter output
    2.9.2. Liquid antistrip meter output

39-1.01C(7) Lime Treatment

If aggregate lime treatment is used, submit the following with your proposed JMF submittal and each time you produce lime-treated aggregate:

1. Exact lime proportions for fine and coarse virgin aggregate
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 authorized JMF for each aggregate size being treated
    3.10. Lime ratio from the authorized 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(8) Warm Mix Asphalt Technology

If a warm mix asphalt technology is used, submit the following with your proposed JMF submittal:

1. MSDS for warm mix asphalt technology

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2. For warm mix asphalt water injection foam technology:
   2.1. Name of technology
   2.2. Proposed foaming water content
   2.3. Proposed HMA production temperature range
   2.4. Certification from binder supplier stating no antifoaming agent is used.

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3. For warm mix asphalt 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

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 mixing plant, 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 mixing plant, the rate of flow of the asphalt meter
9. For a continuous mixing plant, the rate of flow of HMA additive meter
10. For batch plant mixing, 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 from the HMA plant process controller. Present data on electronic media in comma-separated values or tab-separated values format. The 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(9) Samples

For the samples taken for JMF verification, submit 3 parts to the Engineer and use 1 part for your testing.

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.

39-1.01C(10)–39-1.01C(11) Reserved

39-1.01C(12) Data Cores

Section 39-1.01C(12) applies if a bid item for data core is shown on the Bid Item List.

Submit a summary of data cores taken and a photograph of each data core to the Engineer and to:

Coring@dot.ca.gov

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. 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

39-1.01C(13) Pavement Smoothness

39-1.01C(13)(a) General

Reserved

39-1.01C(13)(b) Straightedge Measurements

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(13)(c) Inertial Profiler Certification

At least 5 business days before the start of initial profiling or changing inertial profiler or operator, submit:

1. Inertial profiler certification issued by the Department.
2. Operator certification for the inertial profiler issued by the Department.
3. List of manufacturer's recommended test procedures for the inertial profiler 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 to the Engineer and to the electronic mailbox address:

smoothness@dot.ca.gov

39-1.01C(13)(d) Inertial Profiler Data

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At least 15 days before inertial profiling, you must register with the Department's secure file sharing system. To obtain information on the registration process, send an e-mail with your contact information to the following electronic mailbox address:

smoothness@dot.ca.gov

Within 2 business days after each day of profiling, submit the profile information to the Engineer and to the Department's secure file sharing system. After submitting the profile information to the Department's file sharing system, send a notification of your electronic submittal to the Engineer and to the above electronic mailbox address with the names of the files submitted.

The profiling information must include:

1. Raw profile data for each lane.
2. ProVAL ride quality analysis report for the International Roughness Index of the left and right wheel paths of each lane. Submit each report as a PDF file.
3. ProVAL ride quality analysis report for the Mean Roughness Index of each lane. Submit each report as a PDF file.
4. ProVAL smoothness assurance analysis report for the International Roughness Index of the left and right wheel paths of each lane. Submit each report as a PDF file.
5. ProVAL smoothness assurance analysis reports for the grinding locations of the left and right wheel paths of each lane. Submit each report as a PDF file.
6. GPS data file for each lane. Submit the data file in GPS eXchange file format.
7. Manufacturer's recommended calibration and verification test results for the inertial profiler.
8. Inertial profiler's calibration and verification test results, including bounce, block, and distance measurement instrument.

Submit the raw profile data in an unfiltered electronic pavement profile file format. Use the following file-naming convention:

YYYYMMDD_TTCCCRRR_EA_D_L_W_B_E_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
EA = Contract number, excluding district identification number, expressed as 6 characters
D = traffic direction, *NB*, *SB*, *WB*, or *EB*
L = lane number from left to right in the direction of travel
W = wheel path, *L* for left, *R* for right, or *B* for both
B = beginning station to the nearest foot, such as 10+20, or beginning post mile to the nearest hundredth, such as 25.06, no leading zero
E = ending station to the nearest foot, such as 14+20, or ending post mile to the nearest hundredth, such as 28.06, no leading zero
X = profile operation, *EXIST* for existing pavement, *INTER* for after prepaving smoothness correction, *PAVE* for after paving, and *CORR* for after final surface pavement correction
PT = type of HMA pavement, such as Type A HMA or RHMA-G

If submitting multiple inertial profiler data files, compress the files into a zip format and submit them using the file-naming convention TT_EA_X_YYYYMMDD.zip.

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39-1.01C(13)(e) Reserved

39-1.01C(14)–39-1.01C(15) Reserved

39-1.01D Quality Control and Assurance

39-1.01D(1) General

When testing under AASHTO T 324 (Modified), test under AASHTO T 324 with the following parameters:

1. Target air voids must equal 7.0 ± 1.0 percent
2. Specimen height must be 60 ± 1 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

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7. Measurements for impression must be taken at every 100 passes along the total length of sample
8. Inflection point defined as the number of wheel passes at the intersection of the creep slope and the stripping slope at maximum rut depth
9. Testing shut off must be set at 25,000 passes
10. Submersion time for samples must not exceed 4 hours

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Take samples under California Test 125.

39-1.01D(2) Job Mix Formula Verification

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The Engineer verifies the JMF from samples taken from HMA produced by the plant to be used. The production set point at the plant must be within ±0.2 from the asphalt binder percentage target value shown in your Contractor Job Mix Formula Proposal form. Notify the Engineer at least 2 business days before sampling materials. Samples may be taken from a different project including a non-Department project if you make arrangements for the Engineer to be present during sampling.

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In the Engineer's presence and from the same production run, take samples of:

1. Aggregate. Coarse, fine, and supplemental fine aggregate must be taken from the combined cold feed belt, or hot bins. If lime treatment is required, samples must be taken from individual stockpiles before lime treatment. Samples must be at least 120 lb for each coarse aggregate, 80 lb for each fine aggregate, and 10 lb for each type of supplemental fine aggregate. For hot bin samples, the Department combines these aggregate samples to comply with the TV submitted on a Contractor Job Mix Formula Proposal form.
2. Asphalt binder. Take 2 samples minimum. Each sample must be in a 1-quart cylindrical-shaped can with an open top and friction lid. If the asphalt binder is modified or rubberized, the asphalt binder must be sampled with the components blended in the proportions to be used.
3. RAP. RAP samples must be at least 50 lb from each fractionated stockpile used or 100 lb from the belt.
4. Plant-produced HMA. The HMA samples must be at least 250 lb.

For aggregate, RAP, and HMA, split the samples into at least 4 parts and label their containers. Three parts are for the Department's verification testing and 1 part is for your testing.

After acceptance of the JMF submittal, the Engineer verifies each proposed JMF within 20 days of receiving all verification samples.

For JMF verification, the Engineer tests the following for compliance with the specifications:

1. Aggregate quality
2. Aggregate gradation

3. Voids in mineral aggregate on laboratory-produced HMA must comply with the mix design specifications for voids in mineral aggregate
4. HMA quality characteristics for Department acceptance

To verify the HMA for air voids, voids in mineral aggregate, and dust proportion, the Engineer uses an average of 3 briquettes. The Engineer tests plant-produced material.

If the Engineer verifies the JMF, the Engineer furnishes you a Hot Mix Asphalt Verification form.

If the Engineer's test results on plant-produced samples do not show compliance with the specifications, the Engineer notifies you. Adjust your JMF based on your testing unless the Engineer authorizes reverification without adjustments. JMF adjustments may include a change in:

1. Asphalt binder content target value up to ±0.20 percent from the OBC value submitted on Contractor Hot Mix Asphalt Design Data form
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.

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 JMFs 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.

A verified JMF is valid for 12 months.

39-1.01D(3) Job Mix Formula Authorization

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 authorizes the verified JMF

39-1.01D(4) Job Mix Formula Renewal

For a JMF renewal and upon request, in the Engineer's presence and from the same production run, take samples of:

1. Aggregate. Coarse, fine, and supplemental fine aggregate must be taken from combined cold-feed belt, or hot bins. If lime treatment is required, samples must be taken from individual stockpiles before lime treatment. Samples must be at least 120 lb for each coarse aggregate, 80 lb for each fine aggregate, and 10 lb for each type of supplemental fines. For hot bins, the Department combines these aggregate samples to comply with the TV submitted on a Contractor Job Mix Formula Proposal form.
2. Asphalt binder. Take 2 samples minimum. Each sample must be in a 1-quart cylindrical-shaped can with an open top and friction lid. If the asphalt binder is modified or rubberized, the asphalt binder must be sampled with the components blended in the proportions to be used.
3. RAP. RAP samples must be at least 50 lb from each fractionated stockpile.
4. Plant-produced HMA. The HMA samples must be at least 250 lb.

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 reverification submittal for document review of the aggregate qualities, mix design, and JMF.

The most recent aggregate quality test results within the past 12 months may be used for verification of JMF renewal or upon request, the Engineer may perform aggregate quality tests for verification of JMF renewal.

The Engineer verifies the JMF for renewal under section 39-1.01D(2) except:

1. The Engineer keeps the samples until you provide test results for your part on a Contractor Job Mix Formula Renewal form.
2. The Department tests samples of materials obtained from the HMA production unit after you submit test results that comply with the mix design specifications.
3. After completion of the JMF verification renewal document review, the Engineer verifies each proposed JMF within 20 days of receiving the verification renewal samples and the complete Contractor Job Mix Formula Renewal form.
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 no cost to you 1 proposed JMF renewal within a 12-month period.

If the Engineer verifies the JMF renewal, the Engineer furnishes you a Hot Mix Asphalt Verification form. The Hot Mix Asphalt Verification form is valid for 12 months.

39-1.01D(5) Job Mix Formula Modification

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. The Engineer tests verification samples for compliance with:

1. Hamburg wheel track mix design specifications
2. Air void content
3. Voids in mineral aggregate on plant-produced HMA mix design specifications
4. Dust proportion mix design specifications

The Engineer may test for moisture susceptibility for compliance with the mix design specifications.

If the modified JMF is verified, the Engineer revises your Hot Mix Asphalt Verification form to include the new asphalt binder source, new liquid antistrip producer, or new liquid antistrip dosage. 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 JMF modification.

39-1.01D(6) Certifications

39-1.01D(6)(a) General

Laboratories testing aggregate and HMA qualities used to prepare the mix design and JMF must be qualified under AASHTO Materials Reference Laboratory program and the Department's Independent Assurance Program.

39-1.01D(6)(b) Hot Mix Asphalt Plants

Before production, the HMA plant must have a current qualification under the Department's Material Plant Quality Program.

39-1.01D(6)(c) Inertial Profiler Certifications

The inertial profiler equipment must display a current certification decal with expiration date.

The inertial profiler operator and device certifications must be not more than 12 months old.

The operator must be certified for each different model of inertial profiler device operated.

39-1.01D(6)(d)–39-1.01D(6)(e) Reserved

39-1.01D(7) Prepaving Meeting

Meet with the Engineer at a prepaving meeting at a mutually agreed time and place. Discuss the QC plan and the methods of performing HMA production and paving work.

The following personnel must attend the prepaving meeting:

1. Project manager
2. Superintendent
3. HMA plant manager

4. HMA paving foreman

If a warm mix asphalt technology is used, a technical representative for warm mix asphalt technology must attend the prepaving meeting.

39-1.01D(8) Quality Control

39-1.01D(8)(a) General

QC test results must comply with the specifications for Department acceptance.

Prepare 3 briquettes for air voids content and voids in mineral aggregate determination. Report the average of 3 tests.

Except for smoothness, if 2 consecutive QC test results or any 3 QC test results for 1 day's production do not comply with the materials specifications:

1. Stop HMA production
2. Notify the Engineer
3. Take corrective action
4. Demonstrate compliance with the specifications before resuming production and placement

For QC tests performed under AASHTO T 27, results are considered 1 QC test regardless of number of sieves out of compliance.

Do not resume production and placement until the Engineer authorizes your corrective action proposal.

39-1.01D(8)(b) Reserved

39-1.01D(8)(c) Aggregate

39-1.01D(8)(c)(i) General

Reserved

39-1.01D(8)(c)(ii) Aggregate Lime Treatments

If lime treatment is required, sample coarse and fine aggregate from individual stockpiles before lime treatment. Combine aggregate in the JMF proportions. Test the aggregate under the test methods and frequencies shown in the following table:

10-30-15

Aggregate Quality Control During Lime Treatment

Quality characteristic	Test method	Minimum sampling and testing frequency
Sand equivalent[a, b]	AASHTO T 176	1 per 750 tons of untreated aggregate
Percent of crushed particles	AASHTO T 335	1 per 10,000 tons or 2 per project whichever is greater
Los Angeles Rattler	AASHTO T 96	
Fine aggregate angularity	AASHTO T 304 Method A	
Flat and elongated particles	ASTM D4791	

[a]Report test results as the average of 3 tests from a single sample.
[b]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.

For lime slurry aggregate treatment, determine the aggregate moisture content at least once every 2 hours of treatment. Calculate moisture content under AASHTO T 255 and report it as a percent of dry aggregate weight. Use the moisture content calculations as a set point for the proportioning process controller.

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 a deviation of more than 0.2 percent above or below the lime ratio in the accepted JMF, stop treatment and take corrective action.

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 a deviation of more than 0.2 percent above or below the lime ratio in the accepted JMF, stop treatment and do not use that day's treated aggregate in HMA.

The Engineer may order you to stop aggregate treatment activities for any of following:

1. You fail to submit treatment data log
2. You fail to submit aggregate QC data for marinated aggregate
3. You submit incomplete, untimely, or incorrectly formatted data
4. You do not take corrective actions
5. You take late or unsuccessful corrective actions
6. You do not stop treatment when proportioning tolerances are exceeded
7. You use malfunctioning or failed proportioning devices

If you stop treatment for noncompliance, notify the Engineer of any corrective actions taken and conduct a successful 20-minute test run before resuming treatment.

39-1.01D(8)(d) Liquid Antistrip Treatment

For continuous mixing or batch-plant mixing, sample asphalt binder before adding liquid antistrip. For continuous mixing, sample the combined asphalt binder and liquid antistrip after the static mixer.

39-1.01D(8)(e) Production Start-up Evaluation

You and the Engineer evaluate HMA production and placement at production start-up.

Within the first 750 tons produced on the 1st 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 the combined cold-feed belt or hot bin. Take RAP samples from the RAP system.

For aggregate, RAP, and HMA, split the samples into at least 4 parts and label their containers. Submit 3 parts to the Engineer and keep 1 part.

You and the Engineer must test the samples and report test results, except for AASHTO T 324 (Modified) and AASHTO T 283 test results, within 5 business days of sampling. For AASHTO T 324 (Modified) and AASHTO T 283 test results, report test results within 15 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 one 4- or 6-inch diameter density core for each 250 tons or portion thereof of HMA placed. 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.

39-1.01D(8)(f) Hot Mix Asphalt 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.

Test for in-place density using cores and a nuclear gauge. Test at random locations you select and include the test results in your QC production tests reports.

39-1.01D(8)(g) Tapered Notched Wedge

Perform QC testing on the completed tapered notched wedge joint as follows:

10-30-15

1. Perform density tests using a calibrated nuclear gage at a rate of 1 test for every 750-foot section along the joint. Select random locations for testing within each 750-foot section.
2. Perform density 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 theoretical maximum density.
4. Determine percent compaction of the longitudinal joint as the ratio of the daily average density to the maximum density test results.

04-18-19

Determine percent compaction values each day the tapered notched wedge joint is completed. 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 comply with the specifications.

39-1.01D(8)(h) Density Cores

10-30-15

Except for HMA pavement placed using method compaction, take 4- or 6-inch diameter density cores at least once every 5 business days. Take 1 density core for every 250 tons of HMA from random locations the Engineer selects. Take density cores in the Engineer's presence, and backfill and compact holes with authorized material. Before submitting a density core, mark it with the density core's location and place it in a protective container.

04-18-14

If a density core is damaged, replace it with a density core taken within 1 foot longitudinally from the original density core. Relocate any density core located within 1 foot of a rumble strip to 1 foot transversely away from the rumble strip.

For a tapered notched wedge joint, take 4- or 6-inch diameter density cores 6 inches from the upper vertical notch of the completed longitudinal joint for every 3,000 feet at locations selected by the Engineer. Take cores after the adjacent lane is placed and before opening the pavement to traffic. Take cores in the presence of the Engineer, and backfill and compact holes with authorized material. Before submitting a density core, mark it with the core's location and place it in a protective container.

39-1.01D(8)(i) Reserved

39-1.01D(8)(j) Pavement Smoothness

39-1.01D(8)(j)(i) General

Test pavement smoothness using an inertial profiler except use a 12-foot straightedge for the HMA pavement 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

10-30-15

Where inertial profiler testing is required:

1. Determine the pavement smoothness for each traffic lane by obtaining the International Roughness Index for the left and right wheel paths in an individual lane. The average of the International Roughness Index values for the left and right wheel paths for the same traffic lane is the Mean Roughness Index of the lane. The wheel paths are a pair of lines 3 feet from and parallel to the edge of a traffic lane. Left and right wheel paths are based on the direction of travel.
2. Identify the areas of localized roughness using the FHWA's engineering software ProVAL to perform smoothness assurance analysis. Calculate the continuous International Roughness Index values 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 International Roughness Index filters.

Where OGFC is required, test pavement smoothness of the final HMA or concrete pavement surface before placing OGFC and after placing OGFC.

04-18-14

39-1.01D(8)(j)(ii) Inertial Profiler Calibration and Verification Tests

Operate the inertial profiler according to the manufacturer's instructions and AASHTO R 57 at 1-inch recording intervals.

Notify the Engineer 2 business days before performing inertial profiler calibration and verification testing.

Conduct the following inertial profiler calibration and verification tests in the Engineer's presence each day before performing inertial profiling:

1. Block test. Verify the height sensor accuracy under California Test 387.
2. Bounce test. Verify the combined height sensor and accelerometer accuracy under California Test 387.

10-30-15

3. Distance measurement index test. Verify the accuracy of the distance measuring instrument under California Test 387.

04-18-14

4. Manufacturer's recommended tests.

Conduct cross-correlation inertial profiler verification test in the Engineer's presence before performing initial profiling. Verify cross-correlation inertial profiler verification test at least annually. Conduct 5 repeat runs of the inertial profiler 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 California Test 387 using ProVAL profiler certification analysis with a 3 feet maximum offset. The cross-correlation must be a minimum of 0.92.

39-1.01D(8)(j)(iii) 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 the International Roughness Index values, 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

10-17-14

4. Begin and end of all at-grade intersections

04-18-14

Determine the Mean Roughness Index 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 Mean Roughness Index 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 Mean Roughness Index specifications for a full section. Adjust the Mean Roughness Index 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 International Roughness Index for each wheel path with a 25-foot interval using a 250 mm filter.

39-1.01D(9) Department Acceptance

39-1.01D(9)(a) General

The Department tests treated aggregate for acceptance before lime treatment except for gradation.

The Engineer takes HMA samples for AASHTO T 283 and AASHTO T 324 (Modified) from one of the following:

10-17-14

1. At the plant
2. At the truck
3. Windrow

The Engineer takes HMA samples for all other tests from one of the following:

1. At the plant
2. At the truck
3. Windrow
4. Mat behind the paver

10-30-15

To obtain workability of the HMA sample for splitting, the Engineer reheats each sample of HMA mixture not more than 2 cycles. Each reheat cycle is performed by placing the loose mixture in a mechanical forced-draft oven for 2 hours or less after the sample reaches 140 degrees F.

The Engineer conditions each at-the-plant sample of HMA mixture in compliance with sections 7.1.2, 7.1.3, and 7.1.4 of AASHTO R 30.

04-18-14

The Engineer's sampling and testing is independent of your QC sampling and testing.

If you request, the Engineer splits samples and provides you with a part.

No single test result may represent more than 750 tons or one day's production, whichever is less, excluding AASHTO T 283 and AASHTO T 324 (Modified).

Except for smoothness, if 2 consecutive Department acceptance test results or any 3 Department acceptance test results for 1 day's production do not comply with the specifications:

1. Stop HMA production
2. Take corrective action
3. Demonstrate compliance with the specifications before resuming production and placement

10-17-14

For Department acceptance tests performed under AASHTO T 27, results are considered 1 Department acceptance test regardless of the number of sieves out of compliance.

04-18-14

The Engineer accepts HMA based on:

1. Authorized JMF
2. Authorized QC plan
3. Asphalt binder compliance

4. Asphalt emulsion compliance
5. Visual inspection
6. Pavement smoothness

39-1.01D(9)(b) In-Place Density

10-17-14

Except for HMA pavement placed using method compaction, the Engineer tests the density core you take from each 250 tons of HMA. 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.

10-30-15

Density cores must be taken from the final layer, cored through the entire pavement thickness shown. Where OGFC is required, take the density cores before placing OGFC.

If the percent of theoretical maximum density does not comply with the specifications, the Engineer may accept the HMA and take a payment deduction as shown in the following table:

Reduced Payment Factors for Percent of Maximum Theoretical Density

HMA percent of maximum theoretical density	Reduced payment factor	HMA percent of maximum theoretical density	Reduced payment factor
91.0	0.0000	97.0	0.0000
90.9	0.0125	97.1	0.0125
90.8	0.0250	97.2	0.0250
90.7	0.0375	97.3	0.0375
90.6	0.0500	97.4	0.0500
90.5	0.0625	97.5	0.0625
90.4	0.0750	97.6	0.0750
90.3	0.0875	97.7	0.0875
90.2	0.1000	97.8	0.1000
90.1	0.1125	97.9	0.1125
90.0	0.1250	98.0	0.1250
89.9	0.1375	98.1	0.1375
89.8	0.1500	98.2	0.1500
89.7	0.1625	98.3	0.1625
89.6	0.1750	98.4	0.1750
89.5	0.1875	98.5	0.1875
89.4	0.2000	98.6	0.2000
89.3	0.2125	98.7	0.2125
89.2	0.2250	98.8	0.2250
89.1	0.2375	98.9	0.2375
89.0	0.2500	99.0	0.2500
< 89.0	Remove and replace	> 99.0	Remove and replace

For acceptance of a completed tapered notched wedge joint, the Engineer determines density from cores you take every 3,000 feet.

04-18-14

39-1.01D(9)(c) Pavement Smoothness

For areas that require pavement smoothness determined using an inertial profiler, the pavement surface must:

1. Have no areas of localized roughness with an International Roughness Index greater than 160 in/mi
2. Comply with the Mean Roughness Index requirements shown in the following table for a 0.1 mile section:

HMA Pavement Smoothness Acceptance Criteria

HMA thickness	Mean Roughness Index requirement
> 0.20 foot	60 in/mi or less
≤ 0.20 foot	75 in/mi or less

Note: These requirements do not apply to the OGFC surface. Smoothness requirements for OGFC are specified in section 39-4.01D(3)(c).

Where OGFC is required, the final HMA surface must comply with the Mean Roughness Index requirements before placing OGFC. Correct the pavement surface that does not meet the Mean Roughness Index specifications. Areas of localized roughness greater than 160 in/mi must be corrected regardless of the Mean Roughness Index values of a 0.1-mile section.

04-18-14

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.

For each 0.1 mile section, your International Roughness Index values must be within 10 percent of the Department's International Roughness Index values. The Engineer may order you to recalibrate your inertial profiler equipment and reprofile. If your results are inaccurate due to operator error, the Engineer may disqualify your inertial profiler operator.

39-1.01D(9)(d) 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 the other's test results, submit your test results and copies of paperwork including worksheets used to determine the disputed test results. An independent third party performs referee testing. Before the third party participates in a dispute resolution, it must be qualified under AASHTO Materials Reference Laboratory program, and the Department's Independent Assurance Program. The independent third party must have no prior direct involvement on this Contract. By mutual agreement, the independent third party is chosen from:

1. Department laboratory in a district or region not in the district or region the project is located
2. Transportation Laboratory
3. Laboratory not currently employed by you or your HMA producer

10-30-15

If the Department's portion of the split QC samples or acceptance samples are not available, the independent third party uses any available material representing the disputed HMA for evaluation.

For a dispute involving JMF verification, the independent third party performs referee testing as specified in the 5th paragraph of section 39-1.01D(2).

04-18-14

If the independent third party determines the Department's test results are valid, the Engineer deducts the independent third party's testing costs from payments. If the independent third party determines your test results are valid, the Department pays the independent third party's testing costs.

39-1.02 MATERIALS

39-1.02A General

Reserved

39-1.02B Mix Design

39-1.02B(1) General

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 gradation and asphalt binder contents to determine the OBC and HMA mixture qualities

The Contractor Hot Mix Asphalt Design Data form must show documentation on aggregate quality.

39-1.02B(2) Hot Mix Asphalt Treatments

If the test results for AASHTO T 283 or AASHTO T 324 (Modified) for untreated plant-produced HMA are less than the minimum requirements for HMA mix design, determine the plasticity index of the aggregate blend under California Test 204.

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

If the plasticity index is from 4 to 10, treat the aggregate with dry lime with marination or lime slurry with marination.

If the plasticity index is less than 4, treat the aggregate with dry lime or lime slurry with marination, or treat the HMA with liquid antistrip.

39-1.02B(3) Warm Mix Asphalt Technology

10-30-15

For HMA with warm mix asphalt additive technology, produce HMA mix samples for your mix design using your methodology for inclusion of warm mix asphalt admixture in laboratory-produced HMA. Cure the samples in a forced-air draft oven at 275 degrees F for 4 hours ± 10 minutes.

04-18-14

For warm mix asphalt water injection foam technology, the use of foamed asphalt for mix design is not required.

39-1.02C Asphalt Binder

Asphalt binder must comply with section 92.

10-30-15

For hot mix asphalt (leveling) the grade of asphalt binder for the HMA must be PG 64-10 or PG 64-16.

04-18-14

39-1.02D Aggregate

39-1.02D(1) General

Aggregate must be clean and free from deleterious substances.

The aggregate for hot mix asphalt (leveling) must comply with the gradation specifications for Type A HMA in section 39-2.02.

39-1.02D(2) Aggregate Gradations

10-30-15

Aggregate gradation must be determined before the addition of asphalt binder and must include supplemental fine aggregates. Test for aggregate gradation under AASHTO T 27. Do not wash the coarse aggregate. Wash the fine aggregate only. Use a mechanical sieve shaker. Aggregate shaking time must not exceed 10 minutes for each coarse and fine aggregate portion.

04-18-14

Choose a target value within the target value limits shown in the tables titled "Aggregate Gradations."

Gradations are based on nominal maximum aggregate size.

39-1.02D(3) Aggregate Lime Treatments

39-1.02D(3)(a) General

If aggregate lime treatment is required, virgin aggregate must comply with the aggregate quality specifications.

Lime for treating aggregate must comply with section 24-2.02B.

Water for lime treatment of aggregate with lime slurry must comply with section 24-2.02C.

Notify the Engineer at least 24 hours before the start of aggregate treatment.

Do not treat RAP.

The lime ratio is the pounds of dry lime per 100 lb of dry virgin aggregate expressed as a percentage. Water content of slurry or untreated aggregate must not affect the lime ratio.

Coarse and fine aggregate fractions must have the lime ratio ranges shown in the following table:

Aggregate fractions	Lime ratio percent
Coarse	0.4–1.0
Fine	1.5–2.0
Combined	0.8–1.5

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.

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.

Treated aggregate must not have lime balls or clods.

39-1.02D(3)(b) Dry Lime

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

Proportion dry lime by weight with an automatic continuous proportioning system.

If you use a batch-type proportioning system for HMA production, control proportioning in compliance with the specifications for continuous mixing plants. Use a separate dry lime aggregate treatment system for HMA batch mixing including:

1. Pugmill mixer
2. Controller
3. Weigh belt for the lime
4. Weigh belt for the aggregate

If using a continuous mixing plant for HMA production 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 lime treatment 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 Department's *MPQP* 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 to the aggregate for mixing and coating before dry lime addition. Immediately before mixing lime with aggregate, water must not visibly separate from the 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 process. 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 process 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.

39-1.02D(3)(c) Lime Slurry

For lime slurry aggregate treatment, treat aggregate separate from HMA production. Stockpile and marinate the aggregate.

Proportion lime and water with a continuous or batch mixing system.

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.

Proportion lime slurry and aggregate by weight in a continuous process.

39-1.02E Liquid Antistrip Treatment

Liquid antistrip must be from 0.25 to 1.0 percent by weight of asphalt binder. Do not use liquid antistrip as a substitute for asphalt binder.

Liquid antistrip total amine value must be 325 minimum when tested under ASTM D2074.

Use only 1 liquid antistrip type or brand at a time. Do not mix liquid antistrip types or brands.

Store and mix liquid antistrip under the manufacturer's instructions.

39-1.02F–39-1.02G Reserved

39-1.02H Hot Mix Asphalt Production

39-1.02H(1) General

Do not start HMA production before verification and authorization of JMF.

HMA plants must be Department-qualified. Before production, the HMA plant must have a current qualification under the Department's Material Plant Quality Program.

Weighing and metering devices used for the production of HMA modified with additives must comply with the requirements of the Department's *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.

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 per hour.
6. Complying with the limits of Table B, "Conveyor Scale Testing Extremes," in the Department's *MPQP*

10-17-14

Proportion aggregate by hot or cold-feed control.

Aggregate temperature must not be more than 375 degrees F when mixed with the asphalt binder.

04-18-14

Asphalt binder temperature must be from 275 to 375 degrees F when mixed with aggregate.

Mix HMA ingredients into a homogeneous mixture of coated aggregates.

HMA with or without RAP must not be more than 325 degrees F.

For HMA produced using warm mix asphalt technology, HMA must be at a temperature between 240 and 325 degrees F.

If method compaction is used, HMA must be produced at a temperature between 305 and 325 degrees F.

If you stop production for longer than 30 days, a production start-up evaluation is required.

39-1.02H(2) Liquid Antistrip

If 3 consecutive sets of recorded production data show actual delivered liquid antistrip weight is more than ±1 percent of the authorized mix design liquid antistrip weight, stop production and take corrective action.

If a set of recorded production data shows actual delivered liquid antistrip weight is more than ±2 percent of the authorized mix design liquid antistrip weight, stop production. If the liquid antistrip 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 activities stopped for any of the following:

1. You do not submit data
2. You submit incomplete, untimely, or incorrectly formatted data
3. You do not take corrective actions
4. You take late or unsuccessful corrective actions
5. You do not stop production when proportioning tolerances are exceeded
6. You use malfunctioning or failed proportioning devices

If you stop production, notify the Engineer of any corrective actions taken before resuming.

39-1.02H(3) Warm Mix Asphalt Technology

Proportion all ingredients by weight. The HMA plant process controller 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 plant process controller.

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 plant process controller 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.

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4. If dry HMA additives are used at continuous mixing HMA plants, baghouse dust systems must return all captured material to the mix. This requirement is waived for lime-treated aggregates.

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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.

39-1.02I Geosynthetic Pavement Interlayer

Geosynthetic pavement interlayer must comply with the specifications for pavement fabric, paving mat, paving grid, paving geocomposite grid, or geocomposite strip membrane as shown.

The asphalt binder for geosynthetic pavement interlayer must be PG 64-10, PG 64-16, or PG 70-10.

39-1.02J Tack Coat

Tack coat must comply with the specifications for asphaltic emulsion or asphalt binder. Choose the type and grade.

39-1.02K Miscellaneous Areas and Dikes

For miscellaneous areas and dikes:

1. Choose either the 3/8-inch or 1/2-inch aggregate gradation for Type A HMA.

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2. Minimum asphalt binder content must be 6.40 percent for 3/8-inch aggregate and 5.70 percent for 1/2-inch aggregate. If you request and the Engineer authorizes, you may reduce the minimum asphalt binder content.

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3. Choose asphalt binder Grade PG 64-10, PG 64-16 or PG 70-10.

For HMA used in miscellaneous areas and dikes, sections 39-1.01C, 39-1.01D, 39-1.02B, 39-1.02D(3), and 39-1.02E–J do not apply.

10-30-15

39-1.02L Replace Asphalt Concrete Surfacing

HMA to be used for replacing asphalt concrete surfacing must comply with Type A HMA as specified in section 39-2.

The grade of asphalt binder must be PG 64-10 or PG 64-16.

04-18-14

39-1.03 CONSTRUCTION

39-1.03A General

Do not place HMA on 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

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HMA placed in a windrow on the roadway surface must not extend more than 250 feet in front of the loading equipment or material transfer vehicle.

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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

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 130 degrees F for HMA with warm mix asphalt technology

39-1.03B Spreading and Compacting Equipment

39-1.03B(1) 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 be heated and 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

39-1.03B(2) Material Transfer Vehicle

If a material transfer vehicle is specified, the material transfer vehicle must have sufficient capacity to prevent stopping the paver and must be capable of:

1. Either receiving HMA directly from trucks or using a windrow pickup head to load it from a windrow deposited on the roadway surface
2. Remixing the HMA with augers before transferring into the paver's receiving hopper or feed system
3. Transferring HMA directly into the paver's receiving hopper or feed system

39-1.03B(3) 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.

39-1.03B(4)–39-1.03B(6) Reserved

39-1.03C Surface Preparation

39-1.03C(1) General

Before placing HMA, remove loose paving particles, dirt, and other extraneous material by any means including flushing and sweeping.

39-1.03C(2) Subgrade

Prepare subgrade to receive HMA under the sections for the material involved. Subgrade must be free of loose and extraneous material.

39-1.03C(3) Reserved

39-1.03C(4) Prepaving Inertial Profiler

Section 39-1.03C(4) applies to existing asphalt concrete surfaces receiving an HMA overlay if a bid item for prepaving inertial profiler is shown in the Bid Item List.

Before starting paving activities, perform prepaving inertial profiler measurements. Prepaving inertial profiler includes taking profiles of the existing pavement, analyzing the data with ProVAL to determine existing pavement International Roughness Index, Mean Roughness Index, and areas of localized roughness.

If the Contract includes cold planing, perform prepaving inertial profiler measurements before cold planning.

If the Contract includes replace asphalt concrete surfacing, perform prepaving inertial profiler measurements after replacing the asphalt concrete surfacing.

39-1.03C(5) Prepaving Grinding

Section 39-1.03C(5) applies to all existing asphalt concrete surfaces that will not be cold planned or milled and that will receive an HMA overlay less than or equal to 0.20 foot exclusive of OGFC if a bid item for prepaving grinding day is shown in the Bid Item List.

After performing prepaving inertial profiling, correct areas of localized roughness greater than 180 in/mi.

10-17-14

Notify the Engineer of those areas of localized roughness that cannot be corrected by prepaving grinding according to the ProVAL smoothness assurance analysis grinding report. The Engineer responds to your notification within 5 business days.

04-18-14

For those areas of localized roughness that cannot be corrected by grinding, the Engineer may order you to either (1) not correct the areas of localized roughness or (2) correct areas of localized roughness by a different method and take profiles of the corrected areas with an inertial profiler. Corrective work performed by a different method, including taking profiles of the corrected areas and associated traffic control, is change order work.

If ordered not to correct areas of localized roughness, the smoothness specifications do not apply to the final pavement surface placed in those areas.

10-30-15

After correcting prepaving areas of localized roughness, take profiles of the corrected area and submit profile data as specified in section 39-1.01C(13)(d).

04-18-14

Dispose of grinding residue.

Pave within 7 days of correcting areas.

The final pavement surface must comply with section 39-1.01D(9)(c).

If the Engineer determines more time is required for prepaving grinding than the Contract allows for and if prepaving grinding is a controlling activity, the Engineer makes a time adjustment.

04-18-14

39-1.03C(6) 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 shown in the following table 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
PCC and existing AC surfacing	0.03	0.04	0.03
Planed pavement	0.05	0.06	0.04

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If a stress absorbing membrane interlayer as specified in section 37-2.06 is applied, the tack coat application rates for new HMA apply.

04-18-14

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

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.

39-1.03C(7) Geosynthetic Pavement Interlayer

If specified, place geosynthetic pavement interlayer over a coat of asphalt binder. Place geosynthetic pavement interlayer in compliance with the manufacturer's instructions.

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 ± 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 an interlayer overlap, 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 to 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.

39-1.03D Longitudinal Joints

39-1.03D(1) General

Longitudinal joints in the top layer must match lane lines. Alternate the longitudinal joint offsets in the lower layers at least 0.5 foot from each side of the lane line. You may request other longitudinal joint placement patterns.

A vertical longitudinal joint of more than 0.15 foot is not allowed at any time between adjacent lanes open to traffic.

For HMA thickness of 0.15 foot 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 foot, you must place HMA on adjacent traveled way lanes or shoulder 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 other authorized release agent under the conform tapers to facilitate the taper removal when paving activities resume.

If placing HMA against the edge of existing pavement, sawcut or grind the pavement straight and vertical along the joint and remove extraneous material.

39-1.03D(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.

10-30-15

39-1.03E Pavement Edge Treatments

Construct edge treatment on the HMA pavement as shown.

Where a tapered edge is required, use the same type of HMA used for the adjacent lane or shoulder.

The edge of roadway where the tapered edge is to be placed must have a solid base, free of debris such as loose material, grass, weeds, or mud. Grade the areas to receive the tapered edge as required.

The tapered edge must be placed monolithic with the adjacent lane or shoulder and must be 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 accomplished 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 transitioning to cross roads, driveways, and obstructions.

For the tapered edge, 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 tapered edge must be placed with each lift.

Short sections of hand work are allowed to construct tapered edge transitions.

04-18-14

39-1.03F 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.

39-1.03G 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.

If shoulders or median borders are shown, pave shoulders and median borders adjacent to the lane before opening a lane to traffic.

If shoulder conform tapers are shown, place conform tapers concurrently with the adjacent lane's paving.

If a driveway or a road connection is shown, place additional HMA along the pavement's edge to conform to road connections and driveways. Hand rake, if necessary, and compact the additional HMA to form a smooth conform taper.

39-1.03H Leveling

Section 39-1.03H applies if a bid item for hot mix asphalt (leveling) is shown on the Bid Item List.

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 hot mix asphalt (leveling).

39-1.03I Miscellaneous Areas and Dikes

Prepare the area to receive HMA for miscellaneous areas and dikes, including excavation and backfill as needed.

Spread miscellaneous areas in 1 layer and compact to the specified lines and grades.

In median areas adjacent to slotted median drains, each layer of HMA must not exceed 0.20 foot maximum compacted thickness.

The finished surface must be:

1. Textured uniformly
2. Compacted firmly
3. Without depressions, humps, and irregularities

39-1.03J Replace Asphalt Concrete Surfacing

Where replace asphalt concrete surfacing is shown, remove existing asphalt concrete surfacing and replace with HMA. The Engineer determines the exact limits of asphalt concrete surfacing to be replaced.

Replace asphalt concrete in a lane before the lane is specified to be opened to traffic.

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.

If the base is excavated beyond the specified plane, replace it with HMA. The Department does not pay for this HMA.

Do not use a material transfer vehicle if replace asphalt concrete surfacing is specified.

39-1.03K–39-1.03N Reserved

39-1.03O Compaction

39-1.03O(1) General

Rolling must leave the completed surface compacted and smooth without tearing, cracking, or shoving.

If a vibratory roller is used as a finish roller, turn the vibrator off.

10-30-15

Do not open new HMA pavement to traffic until its mid depth temperature is below 160 degrees F.

04-18-14

If the surface to be paved is both in sunlight and shade, pavement surface temperatures are taken in the shade.

39-1.03O(2) Method Compaction

Use method compaction for any of the following conditions:

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1. HMA pavement thickness shown is less than 0.15 foot
2. Replace asphalt concrete surfacing
3. Leveling courses
4. Areas the Engineer determines conventional compaction and compaction measurement methods are impeded

04-18-14

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.

Method compaction must consist of performing:

1. Breakdown compaction of each layer with 3 coverages using a vibratory roller. The speed of the vibratory roller in miles per hour must not exceed the vibrations per minute divided by 1,000. If the HMA layer thickness is less than 0.08 foot, turn the vibrator off.
2. Intermediate compaction of each layer of HMA with 3 coverages using a pneumatic-tired roller at a speed not to exceed 5 mph.
3. Finish compaction of HMA with 1 coverage using a steel-tired roller.

Start rolling at the lower edge and progress toward the highest part.

The Engineer may order fewer coverages if the layer thickness of HMA is less than 0.15 foot.

39-1.03O(3)–39-1.03O(5) Reserved

39-1.03P Smoothness Corrections

10-30-15

If the pavement surface does not comply with section 39-1.01D(9)(c), grind the pavement to within specified tolerances, remove and replace the pavement, or place an overlay of HMA. Do not start corrective work until your method is authorized.

Do not use equipment with carbide cutting teeth to grind the pavement unless authorized.

Smoothness corrections 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.

04-18-14

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 inertial profiler, reprofile the entire lane length with the inertial profiler device.

Where corrections are made within areas requiring testing with a 12-foot straightedge, retest the corrected area with the straightedge.

39-1.03Q Data Cores

Section 39-1.03Q applies if a bid item for data core is shown on the Bid Item List.

Take data cores of the completed HMA pavement, underlying base, and subbase material. Notify the Engineer 3 business days before coring.

Protect data cores and surrounding pavement from damage.

Take 4-inch or 6-inch diameter data cores:

1. At the beginning, end, and every 1/2 mile within the paving limits of each route on the project
2. After all paving is complete
3. From the center of the specified lane

On a 2-lane roadway, take data cores from either lane. On a 4-lane roadway, take data cores from each direction in the outermost lane. On a roadway with more than 4 lanes, take data cores from the median lane and the outermost lane in each direction.

Each core must include the stabilized materials encountered. You may choose not to recover unstabilized material but you must identify the material. Unstabilized material includes:

1. Granular material
2. Crumbled or cracked stabilized material
3. Sandy or clayey soil

Where data core samples are taken, backfill and compact the holes with authorized material.

After data core summary and photograph submittal, dispose of cores.

39-1.04 PAYMENT

10-30-15

The payment quantity for geosynthetic pavement interlayer is the area measured from the actual pavement area covered.

Except for tack coat used in minor HMA, payment for tack coat is not included in the payment quantity for hot mix asphalt.

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.

The Department does not adjust the unit price for an increase or decrease in the tack coat quantity.

The payment quantity for HMA of the type shown on the Bid Item List is measured based on the combined mixture weight. 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 virgin 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.

The payment quantity for place hot mix asphalt dike of the type shown on the Bid Item List is the length measured from end to end. Payment for the HMA used to construct the dike is not included in the payment for place hot mix asphalt dike.

The payment quantity for place hot mix asphalt (miscellaneous areas) is the area measured for the in-place compacted area. Payment for the HMA used for miscellaneous areas is not included in the payment for place hot mix asphalt (miscellaneous areas).

The payment quantity for replace asphalt concrete is the volume measured based on the specified dimensions and any adjustments ordered.

The Department does not adjust the unit price for an increase or decrease in the prepaving grinding day quantity.

04-18-14

39-2 TYPE A HOT MIX ASPHALT

39-2.01 GENERAL

39-2.01A Summary

Section 39-2 includes specifications for producing and placing Type A hot mix asphalt.

You may produce Type A HMA using an authorized warm mix asphalt technology.

39-2.01B Definitions

Reserved

39-2.01C Submittals

39-2.01C(1) General

Reserved

39-2.01C(2) Job Mix Formula

The JMF must be based on an HMA mix design determined as described in the Superpave Mix Design SP-2 Manual by the Asphalt Institute.

39-2.01C(3) Reclaimed Asphalt Pavement

Submit QC test results for RAP gradation with the combined aggregate gradation within 2 business days of taking RAP samples during HMA production.

39-2.01C(4)–39-2.01C(6) Reserved

39-2.01D Quality Control and Assurance

39-2.01D(1) General

Reserved

39-2.01D(2) Quality Control

39-2.01D(2)(a) General

Reserved

39-2.01D(2)(b) Aggregate

Test the quality characteristics of aggregate under the test methods and frequencies shown in the following table:

10-30-15

Aggregate Testing Frequencies

Quality characteristic	Test method	Minimum testing frequency
Gradation[a]	AASHTO T 27	1 per 750 tons and any remaining part
Sand equivalent[b, c]	AASHTO T 176	
Moisture content[d]	AASHTO T 255	
Crushed particles	AASHTO T 335	1 per 10,000 tons or 2 per project whichever is greater
Los Angeles rattler	AASHTO T 96	
Flat and elongated particles	ASTM D4791	
Fine aggregate angularity	AASHTO T 304 Method A	

[a]If RAP is used, test the combined aggregate gradation under California Test 384.
[b]Reported value must be the average of 3 tests from a single sample.
[c]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.
[d]Test at continuous mixing plants only. If RAP is used, test the RAP moisture content at continuous mixing plant and batch mixing plant.

04-18-14

For lime treated aggregate, test aggregate before treatment and test for gradation and moisture content during HMA production.

39-2.01D(2)(c) Reclaimed Asphalt Pavement

10-17-14

Sample and test processed RAP at a minimum frequency of 1 sample per 1000 tons with a minimum of 6 samples per fractionated stockpile. If the fractionated stockpile has not been augmented, the 3 RAP samples taken and tested for mix design may be part of this minimum sample requirement. 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.

04-18-14

The combined RAP sample when tested under AASHTO T 164 must be within ±2.00 percent of the average asphalt binder content reported on page 4 of your Contractor Hot Mix Asphalt Design Data form. If new fractionated RAP stockpiles are required, the average binder content of the new fractionated RAP stockpile must be within ±2.00 percent of the average binder reported on page 4 of your Contractor Hot Mix Asphalt Design Data form.

The combined RAP sample when tested under AASHTO T 209 must be within ±0.06 of the average maximum specific gravity reported on page 4 of your Contractor Hot Mix Asphalt Design Data form.

During Type A HMA production, sample RAP twice daily and perform QC testing for:

1. Aggregate gradation at least once a day under California Test 384
2. Moisture content at least twice a day

39-2.01D(2)(d) Type A Hot Mix Asphalt Production

Test the quality characteristics of Type A HMA under the test methods and frequencies shown in the following table:

Type A HMA Production Testing Frequencies

Quality characteristic	Test method	Minimum testing frequency
Asphalt binder content	AASHTO T 308 Method A	1 per 750 tons and any remaining part
HMA moisture content	AASHTO T 329	1 per 2,500 tons but not less than 1 per paving day
Air voids content	AASHTO T 269	1 per 4,000 tons or 2 every 5 paving days, whichever is greater
Voids in mineral aggregate	SP-2 Asphalt Mixture Volumetrics	1 per 10,000 tons or 2 per project whichever is greater
Dust proportion	SP-2 Asphalt Mixture Volumetrics	
Density of core	California Test 375	2 per paving day
Nuclear gauge density	California Test 375	3 per 250 tons or 3 per paving day, whichever is greater
Hamburg wheel track	AASHTO T 324 (Modified)	1 per 10,000 tons or 1 per project, whichever is greater
Moisture susceptibility	AASHTO T 283	

39-2.01D(3)–39-2.01D(4) Reserved

39-2.01D(5) Department Acceptance

The Department accepts Type A HMA based on compliance with:

1. Aggregate quality requirements shown in the following table:

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Aggregate Quality

Quality characteristic	Test method	Requirement
Aggregate gradation[a]	AASHTO T 27	JMF ± Tolerance
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
Los Angeles Rattler (max, %) Loss at 100 Rev. Loss at 500 Rev.	AASHTO T 96	 12 40
Sand equivalent (min.)[b, c]	AASHTO T 176	47
Flat and elongated particles (max, % by weight at 5:1)	ASTM D4791	10
Fine aggregate angularity (min, %)[d]	AASHTO T 304 Method A	45

[a]The Engineer determines combined aggregate gradations containing RAP under California Test 384.
[b]Reported value must be the average of 3 tests from a single sample.
[c]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.
[d] 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.

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2. If RAP is used, RAP quality requirements shown in the following table:

Reclaimed Asphalt Pavement Quality

Quality characteristic	Test method	Requirement
Binder content (% within the average value reported)	AASHTO T 164	±2.00
Specific gravity (within the average value reported)	AASHTO T 209	±0.06

3. In-place Type A HMA quality requirements shown in the following table:

Type A HMA Acceptance In Place

Quality characteristic	Test method	Requirement
Asphalt binder content (%)	AASHTO T 308 Method A	JMF -0.30, +0.50
HMA moisture content (max, %)	AASHTO T 329	1.00
Air voids content at N_{design} (%)[a, b]	AASHTO T 269	4.0 ± 1.5 (5.0 ± 1.5 for 1-inch aggregate)
Voids in mineral aggregate on laboratory-produced HMA (min, %)[a]	SP-2 Asphalt Mixture Volumetrics[c]	
Gradation:		
No. 4		16.5–19.5
3/8-inch		15.5–18.5
1/2-inch		14.5–17.5
3/4-inch		13.5–16.5
1-inch		
with NMAS[g] = 1-inch		13.5–16.5
with NMAS[g] = 3/4-inch		14.5–17.5
Voids in mineral aggregate on plant-produced HMA (min, %)[a]	SP-2 Asphalt Mixture Volumetrics[c]	
Gradation:		
No. 4		15.5–18.5
3/8-inch		14.5–17.5
1/2-inch		13.5–16.5
3/4-inch		12.5–15.5
1-inch		
with NMAS[g] = 1-inch		12.5–15.5
with NMAS[g] = 3/4-inch		13.5–16.5
Dust proportion	SP-2 Asphalt Mixture Volumetrics	0.6–1.3[h]
Density of core (% of max theoretical density)[e, f]	California Test 375	91.0–97.0
Hamburg wheel track (min number of passes at 0.5-inch rut depth)	AASHTO T 324 (Modified)	
Binder grade:		
PG 58		10,000
PG 64		15,000
PG 70		20,000
PG 76 or higher		25,000
Hamburg wheel track (min number of passes at inflection point)	AASHTO T 324 (Modified)	
Binder grade:		
PG 58		10,000
PG 64		10,000
PG 70		12,500
PG 76 or higher		15,000
Moisture susceptibility (min, psi, dry strength)	AASHTO T 283	100
Moisture susceptibility (min, psi, wet strength)	AASHTO T 283	70

[a]Prepare 3 briquettes. Report the average of 3 tests.
[b]The Engineer determines the bulk specific gravity of each lab-compacted briquette under AASHTO T 275, Method A, and theoretical maximum specific gravity under AASHTO T 209, Method A.
[c]Determine bulk specific gravity under AASHTO T 275, Method A.
[d]The Engineer determines the laboratory-prepared HMA value for mix design verification only.
[e]The 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
2. AASHTO T 209, Method A to determine theoretical maximum density instead of calculating

test maximum density

[f]The Engineer determines theoretical maximum density under AASHTO T 209, Method A, at the frequency specified in California Test 375, Part 5D.

[g]NMAS means nominal maximum aggregate size.

[h]For treated aggregate, the dust proportion requirement is 0.6–1.5.

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39-2.02 MATERIALS

39-2.02A General

Reserved

39-2.02B Mix Design

The mix design for Type A HMA must comply with the requirements shown in the following table:

Type A HMA Mix Design Requirements

Quality characteristic	Test method	Requirement
Air voids content (%)	AASHTO T 269[a]	$N_{initial}$ > 8.0 N_{design} = 4.0 (N_{design} = 5.0 for 1-inch aggregate) N_{max} > 2.0
Gyration compaction (no. of gyrations)	AASHTO T 312	$N_{initial}$ = 8 N_{design} = 85.0 N_{max} = 130
Voids in mineral aggregate (min, %)[b] Gradation: No. 4 3/8-inch 1/2-inch 3/4-inch 1-inch with NMAS[e] = 1-inch with NMAS[e] = 3/4-inch	SP-2 Asphalt Mixture Volumetrics	 16.5–19.5 15.5–18.5 14.5–17.5 13.5–16.5 13.5–16.5 14.5–17.5
Dust proportion	SP-2 Asphalt Mixture Volumetrics	0.6–1.3
Hamburg wheel track (min number of passes at 0.5-inch rut depth) Binder grade: PG 58 PG 64 PG 70 PG 76 or higher	AASHTO T 324 (Modified)[c]	 10,000 15,000 20,000 25,000
Hamburg wheel track (min number of passes at the inflection point) Binder grade: PG 58 PG 64 PG 70 PG 76 or higher	AASHTO T 324 (Modified)[c]	 10,000 10,000 12,500 15,000
Moisture susceptibility, dry strength (min, psi)	AASHTO T 283[c]	100
Moisture susceptibility, wet strength (min, psi)	AASHTO T 283[c, d]	70

[a]Calculate the air voids content of each specimen using AASHTO T 275, Method A, to determine bulk specific gravity. Use AASHTO T 209, Method A, to determine theoretical maximum specific gravity. Use a digital manometer and pycnometer when performing AASHTO T 209.
[b]Measure bulk specific gravity using AASHTO T 275, Method A.
[c]Test plant produced HMA.
[d]Freeze thaw required.
[e]NMAS means nominal maximum aggregate size.

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For Type A HMA mixtures using RAP, the maximum allowed binder replacement is 25.0 percent in the upper 0.2 feet of HMA exclusive of OGFC and 40.0 percent below. Binder replacement is calculated as a percentage of the approved JMF target asphalt binder content.

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

39-2.02C Asphalt Binder

Reserved

39-2.02D Aggregates

39-2.02D(1) General

Before the addition of asphalt binder and lime treatment, the aggregate must comply with the requirements shown in the following table:

10-30-15

Aggregate Quality

Quality characteristic	Test method	Requirement
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
Los Angeles Rattler (max, %) Loss at 100 Rev. Loss at 500 Rev.	AASHTO T 96	 12 40
Sand equivalent (min)[a, b]	AASHTO T 176	47
Flat and elongated particles (max, % by weight at 5:1)	ASTM D4791	10
Fine aggregate angularity (min, %)[c]	AASHTO T 304 Method A	45

[a]Reported value must be the average of 3 tests from a single sample.
[b]Use of a Sand Reader Indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.
[c] The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate, except if your JMF fails verification. Manufactured sand is fine aggregate produced by crushing rock or gravel.

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39-2.02D(2) Aggregate Gradations

The aggregate gradations for Type A HMA must comply with the requirements shown in the following table:

Aggregate Gradation Requirements

Type A HMA pavement thickness shown	Gradation
0.10 foot	3/8 inch
Greater than 0.10 to less than 0.20 foot	1/2 inch
0.20 foot to less than 0.25 foot	3/4 inch
0.25 foot or greater	3/4 inch or 1 inch

Aggregate gradation must be within the target value limits for the specified sieve size shown in the following tables:

Aggregate Gradations for Type A HMA
(Percentage Passing)

1 inch

Sieve size	Target value limit	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. 50	5–18	TV ± 4
No. 200	3.0–7.0	TV ± 2.0

3/4 inch

Sieve size	Target value limit	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	2.0–7.0	TV ± 2.0

1/2 inch

Sieve sizes	Target value limit	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	2.0–8.0	TV ± 2.0

3/8 inch

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	2.0–9.0	TV ± 2.0

No. 4

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	2.0–12.0	TV ± 4.0

39-2.02E Reclaimed Asphalt Pavement

You may substitute RAP for part of the virgin aggregate in a quantity up to a maximum of 25 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.

For RAP substitution greater than 15 percent of the aggregate blend, fractionate RAP stockpiles into 2 sizes, a coarse fraction RAP retained on 3/8-inch sieve, and a fine fraction RAP passing 3/8-inch sieve.For RAP substitution of 15 percent of the aggregate blend or less, fractionation is not required.

The RAP fractionation must comply with the requirements shown in the following table:

RAP Stockpile Fractionation Gradation Requirements

Quality characteristic	Test method	Requirement
Coarse (% passing the 1-inch sieve)	California Test 202[a]	100
Fine (% passing the 3/8-inch sieve)	California Test 202[a]	98–100

[a]Maximum mechanical shaking time is 10 minutes

You may use the coarse fractionated stockpile, the fine fractionated stockpile, or a combination of the coarse and fine fractionated stockpiles.

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.

39-2.02F Type A Hot Mix Asphalt Production

10-17-14

If RAP is used, the asphalt plant must automatically adjust the virgin asphalt binder to account for RAP percentage and RAP binder.

During production, you may adjust hot or cold-feed proportion controls for virgin aggregate and RAP. RAP must be within ±3 of RAP percentage shown in your Contractor Job Mix Formula Proposal form without exceeding 25 percent.

39-2.03 CONSTRUCTION

10-30-15

Where the pavement thickness shown is greater than 0.30 foot, you may place Type A HMA in multiple lifts not less than 0.15 foot each. If placing Type A HMA in multiple lifts:

1. Aggregate gradation must comply with the requirements shown in the following table:

Aggregate Gradation Requirements

Type A HMA lift thickness	Gradation
0.15 to less than 0.20 foot	1/2 inch
0.20 foot to less than 0.25 foot	3/4 inch
0.25 foot or greater	3/4 inch or 1 inch

2. Apply tack coat before placing a subsequent lift
3. The Engineer evaluates each HMA lift individually for compliance

Spread Type A HMA at the atmospheric and surface temperatures shown in the following table:

Minimum Atmospheric and Surface Temperatures for Type A HMA

Lift thickness, feet	Atmospheric,°F		Surface,°F	
	Unmodified asphalt binder	Modified asphalt binder	Unmodified asphalt binder	Modified asphalt binder
< 0.15	55	50	60	55
≥ 0.15	45	45	50	50

For method compaction, the maximum lift thickness must be 0.25 foot.

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For Type A HMA placed under method compaction, if the asphalt binder is:

1. Unmodified, complete:
   1.1. 1st 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, complete:
   2.1. 1st 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

If you request and the Engineer authorizes, you may cool Type A HMA with water when rolling activities are complete. Apply water under section 17.

39-2.04 PAYMENT

Not Used

39-3 RUBBERIZED HOT MIX ASPHALT–GAP GRADED

39-3.01 GENERAL

39-3.01A Summary

Section 39-3 includes specifications for producing and placing rubberized hot mix asphalt–gap graded.

You may produce RHMA-G using a warm mix asphalt technology.

39-3.01B Definitions

Reserved

39-3.01C Submittals

39-3.01C(1) General

10-17-14

At least 5 business days before use, submit the permit issued by the local air district for asphalt rubber binder blending equipment. If an air quality permit is not required by the local air district for producing asphalt rubber binder, submit verification from the local air district that an air quality permit is not required.

At least 10 days before RHMA-G production, submit the name of an authorized laboratory to perform QC testing for asphalt rubber binder. The authorized laboratory must comply with the Caltrans Independent Assurance Program.

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39-3.01C(2) Job Mix Formula

With your proposed JMF include MSDS for:

1. Base asphalt binder
2. CRM and asphalt modifier
3. Blended asphalt rubber binder components

The JMF must be based on an HMA mix design determined as described in the Superpave Mix Design SP-2 Manual by the Asphalt Institute.

39-3.01C(3) Asphalt Rubber Binder

Submit a proposal for asphalt rubber binder design and profile. In the design, include the asphalt binder, asphalt modifier, and CRM and their proportions.

If you change asphalt rubber binder supplier or any component material used in asphalt rubber binder or its percentage, submit a new JMF.

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 lb.
3. Certified weight slips for the CRM and asphalt modifier furnished.

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4. QC test results on viscosity within 2 business days after sampling.
5. QC test results on cone penetration, resilience, and softening point within 3 business days after sampling.

Submit a certificate of compliance for the CRM and asphalt modifier. With the certificate of compliance, submit test results for CRM and asphalt modifier with each truckload delivered to the HMA plant.

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39-3.01D Quality Control and Assurance

39-3.01D(1) General

Reserved

39-3.01D(2) Job Mix Formula Verification

If you request, the Engineer verifies RHMA-G quality requirements within 7 days of receiving all verification samples and after the JMF document submittal has been accepted.

39-3.01D(3) Quality Control

39-3.01D(3)(a) General

Reserved

39-3.01D(3)(b) Asphalt Rubber Binder

39-3.01D(3)(b)(i) General

The asphalt rubber binder blending plant must be authorized under the Department's Material Plant Quality Program.

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Take asphalt rubber binder samples from the feed line connecting the asphalt rubber binder tank to the HMA plant.

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39-3.01D(3)(b)(ii) Asphalt Modifier

Test asphalt modifier under the test methods and frequencies shown in the following table:

Asphalt Modifier for Asphalt Rubber Binder

Quality characteristic	Test method	Frequency
Viscosity	ASTM D445	1 per shipment
Flash point	ASTM D92	
Molecular Analysis		
Asphaltenes	ASTM D2007	1 per shipment
Aromatics	ASTM D2007	

39-3.01D(3)(b)(iii) Crumb Rubber Modifier

10-30-15

Sample and test scrap tire crumb rubber and high natural crumb rubber separately. Test CRM under the test methods and frequencies shown in the following table:

Crumb Rubber Modifier for Asphalt Rubber Binder

Quality characteristic	Test method	Frequency
Scrap tire crumb rubber gradation	California Test 385	1 per 10,000 lb
High natural crumb rubber gradation	California Test 385	1 per 3,400 lb
Wire in CRM	California Test 385	1 per 10,000 lb
Fabric in CRM	California Test 385	
CRM particle length	--	
CRM specific gravity	California Test 208	
Natural rubber content in high natural crumb rubber	ASTM D297	1 per 3,400 lb

39-3.01D(3)(b)(iv) Asphalt Rubber Binder

Test asphalt rubber binder under the test methods and frequencies shown in the following table:

Quality characteristic	Test method	Frequency
Cone penetration	ASTM D217	1 per lot[a]
Resilience	ASTM D5329	
Softening point	ASTM D36	
Viscosity	ASTM D7741	15 minutes before use per lot[a]

[a]The lot is defined in the Department's *MPQP*.

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Retain the sample from each lot. Test for cone penetration, resilience, and softening point for the first 3 lots and, if all 3 lots pass, the testing frequency may be reduced to once for every 3 lots.

If QC test results indicate that the asphalt rubber binder does not meet the specifications, take corrective action and notify the Engineer.

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39-3.01D(3)(c) Aggregate

Test the quality characteristics of aggregate under the test methods and frequencies shown in the following table:

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Aggregate Testing Frequencies

Quality characteristic	Test method	Minimum testing frequency
Gradation	AASHTO T 27	1 per 750 tons and any remaining part
Sand equivalent[a, b]	AASHTO T 176	
Moisture content[c]	AASHTO T 255	
Crushed particles	AASHTO T 335	1 per 10,000 tons or 2 per project, whichever is greater
Los Angeles rattler	AASHTO T 96	
Flat and elongated particles	ASTM D4791	
Fine aggregate angularity	AASHTO T 304 Method A	

[a]Reported value must be the average of 3 tests from a single sample.
bUse of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.
[c]Test at continuous mixing plants only

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For lime treated aggregate, test aggregate before treatment and test for gradation and moisture content during RHMA-G production.

39-3.01D(3)(d) Rubberized Hot Mix Asphalt–Gap Graded Production

Test the quality characteristics of RHMA-G under the test methods and frequencies shown in the following table:

RHMA-G Production Testing Frequencies

Quality characteristic	Test method	Minimum testing frequency
Asphalt binder content	AASHTO T 308 Method A	1 per 750 tons and any remaining part
HMA moisture content	AASHTO T 329	1 per 2,500 tons but not less than 1 per paving day
Air voids content	AASHTO T 269	1 per 4,000 tons or 2 every 5 paving days, whichever is greater
Voids in mineral aggregate	SP-2 Asphalt Mixture Volumetrics	1 per 10,000 tons or 2 per project whichever is greater
Dust proportion	SP-2 Asphalt Mixture Volumetrics	
Density of core	California Test 375	2 per paving day
Nuclear gauge density	California Test 375	3 per 250 tons or 3 per paving day, whichever is greater
Hamburg wheel track	AASHTO T 324 (Modified)	1 per 10,000 tons or 1 per project, whichever is greater
Moisture susceptibility	AASHTO T 283	

39-3.01D(4) Reserved

39-3.01D(5) Department Acceptance

39-3.01D(5)(a) General

The Department accepts RHMA-G based on compliance with:

1. Aggregate quality requirements shown in the following table:

Aggregate Quality

Quality characteristic	Test method	Requirement
Aggregate gradation	AASHTO T 27	JMF ± Tolerance
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	 -- 90 70
Los Angeles Rattler (max, %) Loss at 100 Rev. Loss at 500 Rev.	AASHTO T 96	 12 40
Sand equivalent (min)[a, b]	AASHTO T 176	47
Flat and elongated particles (max, % by weight at 5:1)	ASTM D4791	Report only
Fine aggregate angularity (min, %)[c]	AASHTO T 304 Method A	45

[a]Reported value must be the average of 3 tests from a single sample.
[b]Use of a sand reading Indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.
[c] The Engineer waives this specification if RHMA-G contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

2. In-place RHMA-G quality requirements shown in the following table:

RHMA-G Acceptance In Place

Quality characteristic	Test method	Requirement
Asphalt binder content (%)	AASHTO T 308 Method A	JMF -0.40, +0.50
HMA moisture content (max, %)	AASHTO T 329	1.00
Air voids content @ N_{design} (%)[a, b]	AASHTO T 269	4.0 ± 1.5
Voids in mineral aggregate on laboratory-produced HMA[d] (min, %) Gradation: 1/2-inch and 3/4-inch	SP-2 Asphalt Mixture Volumetrics[c]	 18.0–23.0
Voids in mineral aggregate on plant-produced HMA (min, %)[a] Gradation: 1/2-inch and 3/4-inch	SP-2 Asphalt Mixture Volumetrics[c]	 17.0–22.0
Dust proportion[a]	SP-2 Asphalt Mixture Volumetrics	Report only
Density of core (% of max theoretical density)[e, f]	California Test 375	91.0–97.0
Hamburg wheel track (min number of passes at 0.5-inch rut depth) Binder grade: PG 58 PG 64 PG 70	AASHTO T 324 (Modified)	 15,000 20,000 25,000
Hamburg wheel track (min number of passes at inflection point) Binder grade: PG 58 PG 64 PG 70	AASHTO T 324 (Modified)	 10,000 12,500 15,000
Moisture susceptibility (min, psi, dry strength)	AASHTO T 283	100
Moisture susceptibility (min, psi, wet strength)	AASHTO T 283	70

[a]Prepare 3 briquettes. Report the average of 3 tests.
[b]The Engineer determines the bulk specific gravity of each lab-compacted briquette under AASHTO T 275, Method A, and theoretical maximum specific gravity under AASHTO T 209, Method A.
[c]Determine bulk specific gravity under AASHTO T 275, Method A.
[d]The Engineer determines the laboratory-prepared RHMA-G value for mix design verification only.
[e]The Engineer determines percent of theoretical maximum density under California Test 375 except the Engineer uses:

1. AASHTO T 275, Method A, to determine in-place density of each density core instead of using the nuclear gauge
2. AASHTO T 209, Method A to determine theoretical maximum density instead of calculating test maximum density.

[f]The Engineer determines theoretical maximum density under AASHTO T 209, Method A, at the frequency specified in California Test 375, Part 5D.

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39-3.01D(5)(b) Asphalt Rubber Binder

39-3.01D(5)(b)(i) General

The Department does not use asphalt rubber binder design profile for production acceptance.

39-3.01D(5)(b)(ii) Asphalt Modifier

The Department accepts asphalt modifier based on compliance with the requirements shown in the following table:

Asphalt Modifier for Asphalt Rubber Binder

Quality characteristic	Test method	Requirement
Viscosity at 100 °C ($m^2/s \times 10^{-6}$)	ASTM D445	X ± 3[a]
Flash point (min, °C)	ASTM D92	207
Molecular Analysis		
Asphaltenes (max, % by mass (max)	ASTM D2007	0.1
Aromatics (min % by mass)	ASTM D2007	55

[a]The symbol "X" is the asphalt modifier viscosity.

39-3.01D(5)(b)(iii) Crumb Rubber Modifier

10-30-15

The Department accepts CRM, scrap tire crumb rubber, and high natural crumb rubber based on compliance with the requirements shown in the following table:

Crumb Rubber Modifier for Asphalt Rubber Binder

Quality characteristic	Test method	Requirement
Scrap tire crumb rubber gradation (% passing No. 8 sieve)	California Test 385	100
High natural scrap tire crumb rubber gradation (% passing No. 10 sieve)	California Test 385	100
Wire in CRM (max, %)	California Test 385	0.01
Fabric in CRM (max, %)	California Test 385	0.05
CRM particle length (max, in)	--	3/16
CRM specific gravity	California Test 208	1.1–1.2
Natural rubber content in high natural crumb rubber (%)	ASTM D297	40.0–48.0

Scrap tire crumb rubber and high natural crumb rubber are sampled and tested separately.

39-3.01D(5)(b)(iv) Asphalt Rubber Binder

10-17-14

For Department acceptance testing, take samples in the Engineer's presence of asphalt rubber binder in 6 qt cans with open tops and friction lids. Take samples once per day or every 5 lots, whichever is greater.

The Department accepts asphalt rubber binder based on compliance with the requirements shown in the following table:

Quality characteristic	Test method	Requirement
Cone penetration at 25 °C (0.10 mm)	ASTM D217	25–70
Resilience at 25 °C (min, % rebound)	ASTM D5329	18
Softening point (°C)	ASTM D36	52–74
Viscosity at 190 °C (centipoises)[a]	ASTM D7741	1,500–4,000

[a]Prepare sample for viscosity test under California Test 388.

04-18-14

39-3.01D(5)(c)–39-3.01D(5)(f) Reserved

39-3.02 MATERIALS

39-3.02A General

Reserved

39-3.02B Rubberized Hot Mix Asphalt–Gap Graded Mix Design

For RHMA-G, the mix design must comply with the requirements shown in the following table:

RHMA-G Mix Design Requirements

Quality characteristic	Test method	Requirement
Air voids content (%)	AASHTO T 269[a]	N_{design} = 4.0
Gyration compaction (no. of gyrations)	AASHTO T 312	N_{design} = 50–150[b]
Voids in mineral aggregate (min, %)	SP-2 Asphalt Mixture Volumetrics[c]	18.0–23.0
Dust proportion	SP-2 Asphalt Mixture Volumetrics	Report only
Hamburg wheel track (min number of passes at 0.5-inch rut depth) Binder grade: PG 58 PG 64 PG 70	AASHTO T 324 (Modified)[d]	 15,000 20,000 25,000
Hamburg wheel track (min number of passes at the inflection point) Binder grade: PG 58 PG 64 PG 70	AASHTO T 324 (Modified)[d]	 10,000 10,000 12,500
Moisture susceptibility, dry strength (min, psi)	AASHTO T 283[d]	100
Moisture susceptibility, wet strength (min, psi)	AASHTO T 283[d, e]	70

[a]Calculate the air voids content of each specimen using AASHTO T 275, Method A, to determine bulk specific gravity and AASHTO T 209, Method A, to determine theoretical maximum specific gravity. Under AASHTO T 209 use a digital manometer and pycnometer when performing AASHTO T 209.
[b]Superpave 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.
[c]Measure bulk specific gravity using AASHTO T 275, Method A.
[d]Test plant produced RHMA.
[e]Freeze thaw required.

Determine the amount of asphalt rubber binder to be mixed with the aggregate for RHMA-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 3 specimens and connect adjacent points with a best-fit curve.
3. Calculate voids in mineral aggregate 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, select the theoretical asphalt rubber binder content at 4 percent air voids.
6. At the selected asphalt rubber binder content, calculate dust proportion.
7. Record the asphalt rubber binder content in the Contractor Hot Mix Asphalt Design Data Form as the OBC.

The OBC must not fall below 7.5 percent by total weight of the mix.

Laboratory mixing and compaction must comply with AASHTO R 35, except the mixing temperature of the aggregate must be between 300 and 325 degrees F. The mixing temperature of the asphalt rubber binder must be between 375 and 425 degrees F. The compaction temperature of the combined mixture must be between 290 and 320 degrees F.

39-3.02C Asphalt Rubber Binder

39-3.02C(1) General

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.

39-3.02C(2) Asphalt Modifier

Asphalt modifier must be a resinous, high flash point, and aromatic hydrocarbon, and must comply with the requirements shown in the following table:

Asphalt Modifier for Asphalt Rubber Binder

Quality characteristic	Test method	Requirement
Viscosity at 100 °C ($m^2/s \times 10^{-6}$)	ASTM D445	X ± 3[a]
Flash point (min, °C)	ASTM D92	207
Molecular Analysis		
Asphaltenes (max, % by mass)	ASTM D2007	0.1
Aromatics (min, % by mass)	ASTM D2007	55

[a]The symbol "X" is the proposed asphalt modifier viscosity. "X" must be between 19 and 36. A change in "X" requires a new asphalt rubber binder design.

Asphalt modifier must be from 2.0 to 6.0 percent by weight of the asphalt binder in the asphalt rubber binder.

39-3.02C(3) Crumb Rubber Modifier

10-30-15

CRM must be a ground or granulated combination of scrap tire crumb rubber and high natural scrap tire crumb rubber. CRM must be 75.0 ± 2.0 percent scrap tire crumb rubber and 25.0 ± 2.0 percent high natural scrap tire crumb rubber by total weight of CRM. Scrap tire crumb rubber and high natural scrap tire crumb rubber must be derived from waste tires described in Pub Res Code § 42703.

The CRM must comply with the requirements shown in the following table:

Crumb Rubber Modifier for Asphalt Rubber Binder

Quality characteristic	Test method	Requirement
Scrap tire crumb rubber gradation (% passing No. 8 sieve)	California Test 385	100
High natural crumb rubber gradation (% passing No. 10 sieve)	California Test 385	100
Wire in CRM (max, %)	California Test 385	0.01
Fabric in CRM (max, %)	California Test 385	0.05
CRM particle length (max, in)[a]	--	3/16
CRM specific gravity	California Test 208	1.1–1.2
Natural rubber content in high natural crumb rubber (%)	ASTM D297	40.0–48.0

[a]Test at mix design and for certificate of compliance.

04-18-14

CRM must be ground or granulated at ambient temperature. If steel and fiber are cryogenically separated, separation must occur before grinding or granulating. Cryogenically produced CRM particles must 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.

39-3.02C(4) Design and Profile

Design the asphalt rubber binder from testing you perform for each quality characteristic and for the reaction temperatures expected during production. The profile must include the same component sources for the asphalt rubber binder used. 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

Quality characteristic	Test Method	Minutes of reaction [a]							Limits
		45	60	90	120	240	360	1440	
Cone penetration at 25 °C (0.10 mm)	ASTM D217	X [b]				X		X	25–70
Resilience at 25 °C (min, % rebound)	ASTM D5329	X				X		X	18
Field softening point (°C)	ASTM D36	X				X		X	52–74
Viscosity (centipoises)	ASTM D7741	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 (960 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

39-3.02C(5) Asphalt Rubber Binder Production

39-3.02C(5)(a) General

10-30-15

Deliver scrap tire crumb rubber and high natural scrap tire crumb rubber in separate bags.

04-18-14

39-3.02C(5)(b) Mixing

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.

After interacting for at least 45 minutes, the quality characteristics of asphalt rubber binder must comply with the requirements shown in the following table:

10-17-14

Quality characteristic	Test method	Requirement
Cone penetration at 25 °C (0.10 mm)	ASTM D217	25–70
Resilience at 25 °C (min, % rebound)	ASTM D5329	18
Softening point (°C)	ASTM D36	52–74
Viscosity at 190 °C (centipoises)[a]	ASTM D7741	1,500–4,000

[a]Prepare sample for viscosity test under California Test 388.

04-18-14

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.

10-30-15

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 crumb rubber to the reheated asphalt rubber binder, the binder must undergo a 45-minute reaction period. The added scrap tire crumb rubber must not exceed 10 percent of the total asphalt rubber binder weight. Reheated and reacted asphalt rubber binder must comply with the viscosity specifications. Do not reheat asphalt rubber binder more than twice.

04-18-14

39-3.02D Aggregates

39-3.02D(1) General

For RHMA-G, before the addition of asphalt binder and lime treatment, the aggregate must comply with the requirements shown in the following table:

10-30-15

Aggregate Quality

Quality characteristic	Test method	Requirement
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	 -- 90 70
Los Angeles Rattler (max, %) Loss at 100 Rev. Loss at 500 Rev.	AASHTO T 96	 12 40
Sand equivalent (min)[a, b]	AASHTO T 176	47
Flat and elongated particles (max, % by weight at 5:1)	ASTM D4791	Report only
Fine aggregate angularity (min, %)[c]	AASHTO T 304 Method A	45

[a]Reported value must be the average of 3 tests from a single sample.
[b]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.
[c]The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate, except if your JMF fails verification. Manufactured sand is fine aggregate produced by crushing rock or gravel.

04-18-14

39-3.02D(2) Aggregate Gradations

The aggregate gradations for RHMA-G must comply with the requirements shown in the following table:

10-17-14

Aggregate Gradation Requirements

RHMA-G pavement thickness shown	Gradation
0.10 to less than 0.20 foot	1/2 inch
0.20 foot or greater	3/4 inch

For RHMA-G, the aggregate gradations must be within the target value limits for the specified sieve size shown in the following tables:

Aggregate Gradations for RHMA-G
(Percentage Passing)

3/4 inch

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	0.0–6.0	TV ± 2.0

1/2 inch

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	0.0–6.0	TV ± 2.0

39-3.02E Rubberized Hot Mix Asphalt–Gap Graded Production

Asphalt rubber binder must be from 375 to 425 degrees F when mixed with aggregate.

If the dry and wet moisture susceptibility test result for treated plant-produced RHMA-G is less than the RHMA-G mix design requirement for dry and wet moisture susceptibility strength, the minimum dry and wet strength requirement is waived, but you must use one of the following treatments:

1. Aggregate lime treatment using the slurry method
2. Aggregate lime treatment using the dry lime method
3. Liquid antistrip treatment of HMA

39-3.03 CONSTRUCTION

Use a material transfer vehicle when placing RHMA-G.

Do not use a pneumatic tired roller to compact RHMA-G.

10-17-14

Spread and compact RHMA-G at an atmospheric temperature of at least 55 degrees F and a surface temperature of at least 60 degrees F.

If the atmospheric temperature is below 70 degrees F, cover loads in trucks with tarps. The tarps must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface. Tarps 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.

For RHMA-G placed under method compaction:

1. Complete the 1st coverage of breakdown compaction before the surface temperature drops below 285 degrees F.
2. Complete breakdown and intermediate compaction before the surface temperature drops below 250 degrees F. Use a static steel-tired roller instead of the pneumatic-tired roller for intermediate compaction.
3. Complete finish compaction before the surface temperature drops below 200 degrees F.

04-18-14

Spread sand at a rate between 1 and 2 lb/sq yd on new RHMA-G 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 of the sand is complete.

39-3.04 PAYMENT

Not Used

39-4 OPEN GRADED FRICTION COURSES

39-4.01 GENERAL

39-4.01A Summary

Section 39-4 includes specifications for producing and placing open graded friction courses. Open graded friction courses include HMA-O, RHMA-O, and RHMA-O-HB.

You may produce OGFC using a warm mix asphalt technology.

39-4.01B Definitions

Reserved

39-4.01C Submittals

Submit a complete JMF, except do not specify an asphalt binder content.

10-30-15

For RHMA-O and RHMA-O-HB, the JMF submittal must comply with section 39-3.01C(3).

04-18-14

39-4.01D Quality Control and Assurance

39-4.01D(1) General

Reserved

39-4.01D(2) Quality Control

39-4.01D(2)(a) General

Reserved

39-4.01D(2)(b) Asphalt Rubber Binder

For RHMA-O and RHMA-O-HB, the asphalt rubber binder must comply with the specifications in 39-3.01D(3)(b).

39-4.01D(2)(c) Aggregate

Test the quality characteristics of aggregate under the test methods and frequencies shown in the following table:

10-30-15

Aggregate Testing Frequencies

Quality characteristic	Test method	Minimum testing frequency
Gradation	AASHTO T 27	1 per 750 tons and any remaining part
Moisture content[a]	AASHTO T 255	1 per 1500 tons and any remaining part
Crushed particles	AASHTO T 335	1 per 10,000 tons or 2 per project, whichever is greater
Los Angeles rattler	AASHTO T 96	
Flat and elongated particles	ASTM D4791	

[a]Test at continuous mixing plants only

For lime treated aggregate, test aggregate before treatment and test for gradation and moisture content during OGFC production.

39-4.01D(2)(d) Open Graded Friction Course Production

Test the quality characteristics of OGFC under the test methods and frequencies shown in the following table:

OGFC Testing Frequencies

Quality characteristic	Test method	Minimum testing frequency
Asphalt binder content	AASHTO T 308 Method A	1 per 750 tons and any remaining part
HMA moisture content	AASHTO T 329	1 per 2,500 tons but not less than 1 per paving day

39-4.01D(3) Department Acceptance

39-4.01D(3)(a) General

The Department accepts OGFC based on compliance with:

1. Aggregate quality requirements shown in the following table:

Aggregate Quality

Quality characteristic	Test method	Requirement
Aggregate gradation	AASHTO T 27	JMF ± Tolerance
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	 90 90 90
Los Angeles Rattler (max, %) Loss at 100 Rev. Loss at 500 Rev.	AASHTO T 96	 12 40
Flat and elongated particles (max, % by weight @ 5:1)	ASTM D4791	Report only

2. In-place OGFC quality requirements shown in the following table:

OGFC Acceptance In Place

Quality characteristic	Test method	Requirement
Asphalt binder content (%)	AASHTO T 308 Method A	JMF -0.40, +0.50
HMA moisture content (max, %)	AASHTO T 329	1.00

39-4.01D(3)(b) Asphalt Rubber Binder

The Department accepts asphalt rubber binder in RHMA-O and RHMA-O-HB under 39-3.01D(5)(b).

39-4.01D(3)(c) Pavement Smoothness

Pavement smoothness of OGFC must comply with the Mean Roughness Index requirements shown in the following table for a 0.1 mile section:

OGFC Pavement Smoothness Acceptance Criteria

OGFC placement on	Mean Roughness Index 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

39-4.01D(3)(d)–39-4.01D(3)(f) Reserved

39-4.02 MATERIALS

39-4.02A General

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.

39-4.02B Open Graded Friction Course Mix Design

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 OGFC, the 1st paragraph of section 39-1.02B(1) does not apply.

39-4.02C Asphalt Binder

Asphalt rubber binder in RHMA-O and RHMA-O-HB must comply with section 39-3.02C.

39-4.02D Aggregate

39-4.02D(1) General

Aggregate must comply with the requirements shown in the following table:

Aggregate Quality

Quality characteristic	Test method	Requirement
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	 -- 90 90
Los Angeles Rattler (max, %) Loss at 100 Rev. Loss at 500 Rev.	AASHTO T 96	 12 40
Flat and elongated particles (max, % by weight at 5:1)	ASTM D4791	Report only

39-4.02D(2) Aggregate Gradations

10-17-14

The aggregate gradations for HMA-O must comply with the requirements shown in the following table:

Aggregate Gradation Requirements

HMA-O pavement thickness shown	Gradation
0.10 foot or greater to less than 0.15 foot	1/2 inch
0.15 foot or greater	1 inch

The aggregate gradations for RHMA-O and RHMA-O-HB must comply with the requirements shown in the following table:

Aggregate Gradation Requirements

RHMA-O and RHMA-O-HB pavement thickness shown	Gradation
0.10 foot or greater	1/2 inch

04-18-14

For RHMA-O and RHMA-O-HB, the 1-inch aggregate gradation is not allowed.

For OGFC, the aggregate gradations must be within the target value limits for the specified sieve size shown in the following tables:

Aggregate Gradations for OGFC
(Percentage Passing)

1 inch

Sieve size	Target value limit	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	0.0–6.0	TV ± 2.0

1/2 inch

Sieve size	Target value limit	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	0.0–3.0	TV ± 2.0

If lime treatment is required, you may reduce the lime ratio for the combined aggregate from 1.0 to 0.5 percent for OGFC.

39-4.03 CONSTRUCTION

Use a material transfer vehicle when placing OGFC.

If the atmospheric temperature is below 70 degrees F, cover loads in trucks with tarps. The tarps must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface. Tarps 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.

Apply a tack coat before placing OGFC. The tack coat application rate must comply with the requirements of the following table:

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
PCC and existing AC surfacing	0.05	0.06	0.04
Planed pavement	0.06	0.07	0.05

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 lb per linear inch of drum width. Turn the vibrator off.

Compact OGFC with 2 coverages. The Engineer may order fewer coverages if the layer thickness of OGFC is less than 0.20 foot.

For HMA-O with unmodified asphalt binder:

1. Spread and compact only if the atmospheric temperature is at least 55 degrees F and the surface temperature is at least 60 degrees F.
2. Complete the 1st 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.

For HMA-O with modified asphalt binder except asphalt rubber binder:

1. Spread and compact only if the atmospheric temperature is at least 50 degrees F and the surface temperature is at least 50 degrees F.
2. Complete the 1st 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.

For RHMA-O and RHMA-O-HB:

1. Spread and compact only 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.

Spread sand at a rate between 1 and 2 lb/sq yd on new 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(3). Keep traffic off the pavement until spreading sand is complete.

If you choose to correct OGFC for smoothness, the Engineer determines if the corrective method causes raveling. OGFC that is raveling must be removed and replaced.

39-4.04 PAYMENT

Not Used

39-5 BONDED WEARING COURSES

39-5.01 GENERAL

39-5.01A General

39-5.01A(1) Summary

Section 39-5 includes specifications for producing and placing bonded wearing courses.

10-30-15

BWC consists of placing a polymer modified asphaltic emulsion and the specified HMA in a single pass with an integrated paving machine.

04-18-14

BWC using RHMA-G, RHMA-O, or HMA-O must comply with the specifications for RHMA-G, RHMA-O, or HMA-O.

39-5.01A(2) Definitions

Reserved

39-5.01A(3) Submittals

With your JMF submittal, include:

1. Asphaltic emulsion target residual rate
2. Weight ratio of water to bituminous material in the original asphaltic emulsion

Within 3 business days following the 1st job site delivery, submit test results for asphaltic emulsion properties performed on a sample taken from the asphaltic emulsion delivered.

Within 1 business day of each job site delivery of asphaltic emulsion, submit to METS a 2-quart sample and a certificate of compliance. Ship each sample so that it is received at METS within 48 hours of sampling.

Each day BWC is placed, submit the residual and application rate for the asphaltic emulsion.

During production, submit certified volume or weight slips for the materials supplied.

39-5.01A(4) Quality Control and Assurance

39-5.01A(4)(a) General

For each job site delivery of asphaltic emulsion, take a 2-quart sample in the presence of the Engineer. Take samples from the delivery truck at mid-load from a sampling tap or thief. If the sample is taken from the tap, draw and discard 4 quarts before sampling.

If you unload asphalt binder or asphaltic emulsion into a bulk storage tank, do not use material from the tank until you submit test results for a sample taken from the bulk storage tank. Testing must be performed by an AASHTO-accredited laboratory.

39-5.01A(4)(b) Quality Control

Sample BWC in two 1-gallon metal containers.

The asphaltic emulsion must be tested under ASTM D2995 at least once per paving day at the job site.

39-5.01A(4)(c) Department Acceptance

The Department accepts asphaltic emulsion based on compliance with the requirements shown in the following table:

10-17-14

Asphaltic Emulsion

Quality characteristic	Test method	Requirement
Saybolt Furol Viscosity at 25 °C (SFS) [a]	AASHTO T 59	20–100
Sieve test on original emulsion at time of delivery (max, %)	AASHTO T 59	0.05
24-hour storage stability (max, %)	AASHTO T 59	1
Residue by evaporation (min, %)	California Test 331	63
Tests on residue from evaporation test:		
Torsional recovery, measure entire arc of recovery at 25 °C (min, %)	California Test 332	40
Penetration at 25 °C (0.01 mm)	AASHTO T 49	70–150

[a]SFS means Saybolt Furol seconds

04-18-14

The Department accepts the BWC based on the submitted asphaltic emulsion target residual rate ±0.02 gal/sq yd when tested under ASTM D2995.

39-5.01B Materials

39-5.01B(1) General

Reserved

39-5.01B(2) Asphaltic Emulsion

The asphaltic emulsion must comply with the requirements shown in the following table:

10-17-14

Asphaltic Emulsion

Quality characteristic	Test method	Requirement
Saybolt Furol Viscosity at 25 °C (SFS) [a]	AASHTO T 59	20–100
Sieve test on original emulsion at time of delivery (max, %)	AASHTO T 59	0.05
24-hour storage stability (max, %)	AASHTO T 59	1
Residue by evaporation (min, %)	California Test 331	63
Tests on residue from evaporation test:		
Torsional recovery, measure entire arc of recovery at 25 °C (min, %)	California Test 332	40
Penetration at 25 °C (0.01 mm)	AASHTO T 49	70–150

[a] SFS means Saybolt Furol seconds

04-18-14

39-5.01B(3) Reserved

39-5.01C Construction

39-5.01C(1) General

Use method compaction for BWC.

Do not dilute the asphaltic emulsion.

Do not place BWC if rain is forecast for the project area within 24 hours by the National Weather Service.

39-5.01C(2) Spreading and Compacting Equipment

Use a material transfer vehicle when placing BWC.

Use an integrated distributor paver capable of spraying the asphaltic emulsion, spreading the HMA, and leveling the mat surface in 1 pass.

Apply asphaltic emulsion at a uniform rate for the full paving width. The asphaltic emulsion must not be touched by any part of the paver including wheels or tracks.

If the spray bar is adjusted for changing pavement widths, the paver must prevent excess spraying of asphaltic emulsion beyond 2 inches of the HMA edge.

39-5.01C(3) Applying Asphaltic Emulsion

10-17-14

Before spreading HMA, apply asphaltic emulsion on dry or damp pavement with no free water.

04-18-14

Apply emulsion at a temperature from 120 to 180 degrees F and in a single application at the residual rate specified for the condition of the underlying surface. Asphaltic emulsion must have a target residual rate for the surfaces to receive the emulsion as shown in the following table:

Asphaltic Emulsion Target Residual Rate

Surface to receive asphaltic emulsion	Target residual rates (gal/sq yd)
PCC pavement	0.09–0.11
Dense, compacted, new HMA pavement	0.11–0.14
Open textured, dry, aged or oxidized existing AC pavement	0.13–0.17

If requested and authorized, you may change the asphaltic emulsion application rates.

39-5.01C(4) Placing and Compacting Hot Mix Asphalt

Construct a transverse joint if the HMA remains in the paver for more than 30 minutes.

Do not reintroduce HMA spread over asphaltic emulsion into the paving process.

Do not overlap or hot lap HMA. Pave through lanes after paving adjacent:

1. Shoulders
2. Tapers
3. Transitions
4. Road connections
5. Driveways
6. Curve widenings
7. Chain control lanes
8. Turnouts
9. Turn pockets
10. Ramps

For BWC placed on areas adjacent to through lanes that extend into the through lanes, cut the BWC to a neat, straight vertical line at the lane line.

If you spill asphaltic emulsion into the paver hopper, stop paving and remove the contaminated material.

10-30-15

39-5.01D Payment

Payment for asphaltic emulsion is not included in the payment for the type of HMA used in a bonded wearing course.

04-18-14

39-5.02 BONDED WEARING COURSES-GAP GRADED

39-5.02A General

39-5.02A(1) Summary

Section 39-5.02 includes specifications for producing bonded wearing course-gap graded.

39-5.02A(2) Definitions

Reserved

39-5.02A(3) Submittals

Include film thickness and calculations and AASHTO T 305 results with your JMF submittal.

39-5.02A(4) Quality Control and Assurance

39-5.02A(4)(a) General

Reserved

39-5.02A(4)(b) Quality Control

39-5.02A(4)(b)(i) General

Reserved

39-5.02A(4)(b)(ii) Aggregate

Test the quality characteristics of aggregate under the test methods and frequencies shown in the following table:

10-30-15

Aggregate Testing Frequencies

Quality characteristic	Test method	Minimum testing frequency
Gradation	AASHTO T 27	1 per 750 tons and any remaining part
Sand equivalent[a, b]	AASHTO T 176	
Moisture content[c]	AASHTO T 255	1 per 1500 tons and any remaining part
Crushed particles	AASHTO T 335	1 per 10,000 tons or 2 per project, whichever is greater
Los Angeles rattler	AASHTO T 96	
Flat and elongated particles	ASTM D4791	
Fine aggregate angularity	AASHTO T 304 Method A	

[a]Reported value must be the average of 3 tests from a single sample.
[b]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2, and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.
[c]Test at continuous mixing plants only.

04-18-14

For lime treated aggregate, test aggregate before treatment and test for gradation and moisture content during BWC-G production.

39-5.02A(4)(b)(iii) Hot Mix Asphalt Production

Sample BWC in two 1-gallon metal containers.

Test the quality characteristics of BWC-G under the test methods and frequencies shown in the following table:

BWC-G Testing Frequencies

Quality characteristic	Test method	Minimum testing frequency
Asphalt binder content	AASHTO T 308 Method A	1 per 750 tons and any remaining part
HMA moisture content	AASHTO T 329	1 per 2,500 tons but not less than 1 per paving day

39-5.02A(4)(b)(iv)–39-5.02A(4)(b)(vii) Reserved

39-5.02A(4)(c) Department Acceptance

The Department accepts BWC-G based on compliance with:

1. Asphalt binder content at JMF -0.40, +0.50 percent when tested under AASHTO T 308, Method A.
2. Aggregate quality requirements shown in the following table:

10-30-15

Aggregate Quality

Quality characteristic	Test method	Requirement
Aggregate gradation	AASHTO T 27	JMF ± Tolerance
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	 -- 90 85
Los Angeles Rattler (max, %) Loss at 100 Rev. Loss at 500 Rev.	AASHTO T 96	 12 35
Sand equivalent (min)	AASHTO T 176	47
Flat and elongated particles (max, % by weight at 5:1)	ASTM D4791	25
Fine aggregate angularity (min, %)	AASHTO T 304 Method A	45

[a]Reported value must be the average of 3 tests from a single sample.
[b]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.

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39-5.02B Materials

39-5.02B(1) General

Reserved

39-5.02B(2) Mix Design

For BWC-G, the 1st paragraph of section 39-1.02B(1) does not apply.

Determine the proposed OBC from a mix design that complies with the requirements shown in the following table:

Hot Mix Asphalt Mix Design Requirements

Quality characteristic	Test method	Requirement
Film thickness (min, µm)	Asphalt Institute MS-2 Table 6.1 [a]	12
Drain down (max, %)	AASHTO T 305 [b]	0.1

[a] Film thickness is calculated based on the effective asphalt content and determined as follows:

$$FT = \left(\frac{P_{be}}{SA \times G_b \times 1000} \right) 10^6$$

Where:

FT = Film thickness in µm
P_{be} = Effective asphalt content by total weight of mix using SP-2 Asphalt Mixture
SA = Estimated surface area of the aggregate blend in m^2/kg from Table 6.1 in the Asphalt Institute Manual Series No. 2 (MS-2).
G_b = Specific gravity of asphalt binder

[b] Combine aggregate and asphalt at the asphalt binder supplier's instructed mixing temperature. Coated aggregates that fall through the wire basket during loading must be returned to the basket before conditioning at 350 °F for 1 hour.

The OBC must be greater than 4.9 percent by total weight of mix.

39-5.02B(3) Asphalt Binder

Reserved

39-5.02B(4) Aggregate

The aggregate must comply with the requirements shown in the following table:

10-30-15

Aggregate Quality

Quality characteristic	Test method	Requirement
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	 -- 90 85
Los Angeles Rattler (max, %) Loss at 100 Rev. Loss at 500 Rev.	AASHTO T 96	 12 35
Sand equivalent (min)	AASHTO T 176	47
Flat and elongated particles (max, % by weight @ 5:1)	ASTM D4791	25
Fine aggregate angularity (min, %)	AASHTO T 304 Method A	45

[a]Reported value must be the average of 3 tests from a single sample.
[b]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, 7.1.2, 8.4.2 and 8.4.3 do not apply. Prepare the stock solution as specified in section 4.8.1, except omit the addition of formaldehyde.

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The aggregate gradations for BWC-G must comply with the requirements shown in the following table:

10-17-14

Aggregate Gradation Requirements

BWC-G pavement thickness shown	Gradation
less than 0.08 foot	No. 4 or 3/8 inch
0.08 foot or greater	1/2 inch

04-18-14

The proposed aggregate gradation must be within the TV limits for the specified sieve sizes shown in the following tables:

Aggregate Gradations for BWC-G
(Percentage Passing)

1/2 inch

Sieve sizes	Target value limits	Allowable tolerance
3/4"	100	--
1/2"	80–100	TV ± 6
3/8"	55–80	TV ± 6
No. 4	25–40	TV ± 7
No. 8	19–32	TV ± 5
No. 16	16–22	TV ± 5
No. 30	10–18	TV ± 4
No. 50	8–13	TV ± 4
No. 100	6–10	TV ± 2
No. 200	4.0–7.0	TV ± 2.0

3/8 inch

Sieve sizes	Target value limits	Allowable tolerance
1/2"	100	--
3/8"	80–100	TV ± 6
No. 4	25–40	TV ± 7
No. 8	19–32	TV ± 5
No. 16	16–22	TV ± 5
No. 30	10–18	TV ± 4
No. 50	8–13	TV ± 4
No. 100	7–11	TV ± 2
No. 200	6.0–10.0	TV ± 2.0

No. 4

Sieve sizes	Target value limits	Allowable tolerance
1/2"	100	--
3/8"	95–100	TV ± 2
No. 4	42–55	TV ± 7
No. 8	19–32	TV ± 5
No. 16	16–22	TV ± 5
No. 30	10–18	TV ± 4
No. 50	8–13	TV ± 4
No. 100	7–11	TV ± 2
No. 200	6.0–10.0	TV ± 2.0

39-5.02C Construction

10-30-15

Apply asphaltic emulsion when the atmospheric and pavement temperatures are above 50 degrees F.

39-5.02D Payment

Not Used

39-6 HOT MIX ASPHALT ON BRIDGE DECKS

39-6.01 GENERAL

Section 39-6 includes specifications for producing and placing hot mix asphalt on bridge decks.

HMA used for bridge decks must comply with the specifications for Type A HMA in section 39-2.

39-6.02 MATERIALS

Do not use the 1-inch or 3/4-inch aggregate gradation for HMA on bridge decks.

The grade of asphalt binder for HMA must be PG 64-10 or PG 64-16.

39-6.03 CONSTRUCTION

Spread and compact HMA on bridge decks using method compaction.

If a concrete expansion dam is to be placed at a bridge deck expansion joint, tape oil-resistant construction paper to the deck over the area to be covered by the dam before placing the tack coat and HMA across the joint.

Apply tack coat at the minimum residual rate specified in section 39-1.03C(5). For HMA placed on a deck seal, use the minimum residual rate specified for PCC.

For HMA placed on a deck seal:

1. Place the HMA within 7 days after installing the deck seal.
2. If a paper mask is placed on the deck under section 54-5.03, place the HMA continuously across the paper mask.
3. Place HMA in at least 2 approximately equal layers.
4. For placement of the 1st HMA layer:
   - 4.1. Comply with the HMA application temperature recommended by the deck seal manufacturer.
   - 4.2. Deliver and place HMA using equipment with pneumatic tires or rubber-faced wheels. Do not operate other vehicles or equipment on the bare deck seal.
   - 4.3. Deposit HMA on the deck seal in such a way that the deck seal is not damaged. Do not use a windrow.
   - 4.4. Place HMA in a downhill direction on bridge decks with grades over 2 percent.
   - 4.5. Self-propelled spreading equipment is not required.

39-6.04 PAYMENT

Not Used

39-7 MINOR HOT MIX ASPHALT

39-7.01 GENERAL

39-7.01A Summary

Section 39-7 includes specifications for producing and placing minor hot mix asphalt.

Minor HMA must comply with section 39-2 except as specified in this section 39-7.

39-7.01B Definitions

Reserved

39-7.01C Submittals

The QC plan, test results, and inertial profiler specifications in sections 39-1.01C(3), 39-1.01C(4), 39-1.01C(13)(c)–(d) do not apply.

39-7.01D Quality Control and Assurance

39-7.01D(1) General

For minor HMA, the JMF renewal, inertial profiler certifications and testing, and prepaving meeting specifications in sections 39-1.01D(4), 39-1.01D(6)(c), and 39-1.01D(7) do not apply.

Test pavement smoothness with a 12 foot straightedge.

39-7.01D(2) Quality Control

For minor HMA, section 39-2.01D(2) applies except testing for compliance with the following quality characteristics is not required:

1. Flat and elongated particles
2. Fine aggregate angularity
3. Hamburg wheel track
4. Moisture susceptibility

39-7.01D(3) Department Acceptance

The Department accepts minor HMA under section 39-2.01D(5) except compliance with the following quality characteristics is not required:

1. Flat and elongated particles
2. Fine aggregate angularity
3. Hamburg wheel track
4. Moisture susceptibility

39-7.02 MATERIALS

39-7.02A General

Reserved

39-7.02B Mix Design

The mix design for minor HMA must comply with section 39-2.02B except the Hamburg wheel track and moisture susceptibility requirements do not apply.

39-7.02C Asphalt Binder

The grade of asphalt binder for minor HMA must be PG-64-10 or PG-64-16.

39-7.02D Liquid Antistrip Treatment

10-17-14

Treat minor HMA with liquid antistrip. Liquid antistrip treatment is not required if you submit AASHTO T 283 and AASHTO T 324 (Modified) test results showing compliance with section 39-2.02B. The tests must be dated within 12 months of submittal.

04-18-14

39-7.03 CONSTRUCTION

Not Used

39-7.04 PAYMENT

Not Used

39-8–39-10 RESERVED

^^

40 CONCRETE PAVEMENT

10-30-15

Replace the headings and paragraphs in section 40 with:

07-19-13

40-1 GENERAL

40-1.01 GENERAL

40-1.01A Summary

Section 40-1 includes general specifications for constructing concrete pavement.

40-1.01B Definitions

concrete raveling: Progressive disintegration of the pavement surface resulting from dislodged aggregate.

full depth crack: Crack that runs from one edge of the slab to the opposite or adjacent side of the slab, except a crack parallel to and within 0.5 foot of either side of a planned contraction joint

working crack: Crack that extends through the full depth of the slab and is parallel to and within 0.5 foot of either side of a planned contraction joint.

action limit: Value at which corrective actions must be made while production may continue.

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_TTCCCRRR_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:

Acceptance Testing

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

[a]A single test represents no more than the frequency specified.
[b]Tested 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:

$$t = \frac{\left|\overline{X}_c - \overline{X}_v\right|}{S_p\sqrt{\frac{1}{n_c} + \frac{1}{n_v}}} \quad \text{and} \quad S_p^2 = \frac{S_c^2(n_c - 1) + S_v^2(n_v - 1)}{n_c + n_v - 2}$$

where:

n_c = Number of your quality control tests (minimum of 6 required)
n_v = Number of Department's tests (minimum of 2 required)
$\overline{X}_c$ = Mean of your quality control tests
$\overline{X}_v$ = 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 tcrit, 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	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	The minimum distance measured from concrete pavement surface to any point along the top of dowel bar must be: DB + 1/2 inch where: DB = one third of pavement thickness in inches, or the saw cut depth, whichever is greater The maximum distance below the depth shown must be 5/8 inch.

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

10-30-15

Construct edge treatments as shown. Regrade when required for the preparation of tapered edge areas.

Sections 40-1.03J(2) and 40-1.03J(3) do not apply to tapered edges.

For tapered edges placed after the concrete pavement is complete, concrete may comply with the requirements for minor concrete.

For tapered edges placed after the concrete pavement is complete, install connecting bar reinforcement under section 52.

Saw cutting or grinding may be used to construct tapered edges.

For tapered 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.

07-19-13

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

10-30-15

Construct shoulder rumble strips by 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.

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,

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.

07-19-13

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

[a]Values 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.

Saw cut full slabs at the longitudinal and transverse joints. Saw cut partial slabs at joints and at locations determined by the Engineer. Saw cut must be vertical.

After lifting the slab, paint the cut ends of dowels and tie bars.

Construct transverse and longitudinal construction joints between the new slab and existing concrete. If slabs are constrained at both longitudinal edges by existing pavement, use dowel bars instead of tie bars. For longitudinal joints, offset dowel bar holes from original tie bars by 3 inches. For transverse joints, offset dowel bar holes from the original dowel bar by 3 inches.

Drill and bond bars to the existing concrete. Comply with section 41-10. Clean the faces of joints and underlying base from loose material and contaminants. Coat the faces with a double application of pigmented curing compound under section 28-2.03F. For partial slab replacements, place preformed sponge rubber expansion joint filler at new transverse joints under ASTM D 1752. Place concrete in the removal area.

40-4.03C–40-4.03G Reserved

40-4.04 PAYMENT

Not Used

40-5 JOINTED PLAIN CONCRETE PAVEMENT WITH RAPID STRENGTH CONCRETE

Reserved

40-6–40-15 RESERVED

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41 CONCRETE PAVEMENT REPAIR

10-30-15

Replace the headings and paragraphs in section 41 with:

10-30-15

41-1 GENERAL

41-1.01 GENERAL

41-1.01A Summary

Section 41-1 includes general specifications for repairing concrete pavement.

Dowel bars must comply with section 40-1.

41-1.01B Definitions

Reserved

41-1.01C Submittals

At least 15 days before delivering fast-setting concrete, polyester resin binder, or bonding agent to the job site, submit the manufacturer's recommendations, instructions, MSDS, and certificates of compliance. Notify the Engineer if polyester resin binder will be stored in containers over 55 gallons.

41-1.01D Quality Control and Assurance

41-1.01D(1) General

Before using polyester concrete:

1. Allow 14 days for sampling and testing of the polyester resin binder
2. Arrange for a representative from the manufacturer to provide training for:
   - 2.1. Cleaning and preparing the area
   - 2.2. Mixing and applying the bonding agent
   - 2.3. Mixing, placing, and curing polyester concrete

Do not use polyester concrete until your personnel and the Department's personnel have been trained.

41-1.01D(2) Reserved

41-1.02 MATERIALS

41-1.02A General

Water for washing aggregates, mixing concrete, curing, and coring must comply with section 90-1.02D.

Use the minimum amount of water to produce workable concrete and comply with the manufacturer's instructions.

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

[a]Perform test with aggregate filler if used.
[b]Test 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 (min, MPa) Type I specimen, 6.3 ± 0.76 mm (0.25 ± 0.03 inch) thick Speed of testing = 11.4 mm/min (0.45 inch/minute) Condition 18/25/50+5/70: T—23/50	ASTM D638 ASTM D618	17.24 (2,500 psi)
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

[a]Perform the test before adding initiator.
[b]For the test method, go to:
http://www.aqmd.gov/

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 sections 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 the specifications for minor HMA in section 39.

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

[a]Perform 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

41-4.01A Summary

Section 41-4 includes specifications for repairing spalls in concrete pavement.

41-4.01B Definitions

Reserved

41-4.01C Submittals

Reserved

41-4.01D Quality Control and Assurance

The Engineer accepts spall repairs based on authorized dimensions and visual inspection.

41-4.02 MATERIALS

Bonding agent must comply with the requirements for HMWM in section 41-3.02 except the tack-free time requirements do not apply and the HMWM must not contain wax.

Caulk must be at least 50 percent silicone, designated as a concrete sealant, and comply with ASTM C834.

Form board must be single-wall, double-face corrugated cardboard or paperboard covered with a bond breaker on each face. For existing joints or cracks less than 45 mils wide, use paperboard.

41-4.03 CONSTRUCTION

41-4.03A General

Prepare spall areas by removing concrete and cleaning. Provide compression relief at joints and cracks by using a form board or saw cutting.

Repair spalls using polyester concrete with a bonding agent.

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 Compression Relief at Joints and Cracks

41-4.03D(1) Form Board Installation

Before placing concrete, place the form board to match the existing joint or crack alignment and width. Extend the form board at least 3 inches beyond each end of the repair and at least 1 inch deeper than the repair.

After placing concrete, remove the form board before sealing joints or cracks.

41-4.03D(2) Saw Cut Method

After cleaning, seal the existing joint or crack and any other exposed cracks with caulk at the bottom and sides of the repair area. Any surface receiving caulk must be clean and dry. Place caulk a minimum of 1/2 inch beyond the edges of the repair area into the existing joint or crack.

Saw cut the polyester concrete to the full depth along the existing joint or crack alignment within 2 hours from time of final setting. Use a power-driven saw with a diamond blade.

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 General

Reserved

41-6.03B 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.

41-6.03C Seating

Seat cracked concrete by making at least 5 passes over the cracked concrete with either:

1. 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. The roller's gross static weight must be 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.

41-6.03D 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 minor HMA under section 39. Use the no. 4 gradation.
2. Remove all loose debris and sweep the pavement.

41-6.03E 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 minor HMA that complies with section 39. 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 C31. 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)

[a]Test at the most frequent interval.
[b]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 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–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 Placing 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 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.

41-9.03E Joints

41-9.03E(1) General

Joints must be vertical.

41-9.03E(2) Construction Joints

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.

41-9.03E(3) Contraction Joints

Saw contraction joints before cracking occurs and after the RSC is hard enough to saw without spalling, raveling, or tearing. Cut contraction joints to a minimum of 1/3 the slab depth. Use a power-driven saw with a diamond blade.

Match transverse contraction joints with existing joint spacing and skew unless otherwise described. Where the existing transverse joint spacing in an adjacent lane exceeds 15 feet, construct an additional transverse contraction joint midway between the existing joints.

Cut transverse contraction joints across the full slab replacement width. After cutting, immediately wash slurry from the joint with water at less than 100 psi pressure.

Longitudinal contraction joints must be parallel with the concrete pavement centerline, except when lanes converge or diverge. Transverse and longitudinal contraction joints must not deviate by more than 0.1 foot from either side of a 12-foot straight line. For longitudinal joints parallel to a curved centerline radius less than 7000 feet, compensate for curvature.

Keep joints free from foreign material including soil, gravel, concrete, and asphalt.

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–41-9.03K 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.

Cut the rejected bar flush with the pavement joint surface and coat the exposed end of the bar with chemical adhesive. Offset the new hole 3 inches horizontally from the rejected hole's center.

41-10.03B Tie Bar Tolerance

Place tie bars within the tolerances shown in the following table:

Tie Bar Tolerances

Dimension	Tolerance
Horizontal skew (horizontal skew: bar length)	1:6
Vertical skew (vertical skew: bar length)	1:6
Longitudinal translation (inch)	±1
Horizontal offset (embedment, inch)	±1
Height relative to the adjacent bar	±1
Vertical Depth (clearance from the pavement surface or bottom, inches, min)	3

41-10.03C Dowel Bar Tolerance

Place dowel bars within the tolerances specified in section 40-1.01D(7)(b)(v).

41-10.03D Reserved

41-10.04 PAYMENT

Not Used

41-11–41-15 RESERVED

^^

42 GROOVE AND GRIND CONCRETE

07-19-13

Replace the paragraph of section 42-1.01A with:

07-19-13

Section 42-1 includes general specifications for grooving and grinding concrete.

Replace the headings and paragraphs in section 42-3 with:

07-19-13

42-3.01 GENERAL

42-3.01A Summary

Section 42-3 includes specifications for grinding the surfaces of pavement, bridge decks, and approach slabs.

42-3.01B Definitions

Reserved

42-3.01C Submittals

Reserved

42-3.01D Quality Control and Assurance

Reserved

42-3.02 MATERIALS

Not Used

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

^^^

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

07-19-13

Delete the 3rd paragraph of section 46-2.01A.

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.

Replace the 1st sentence of the 1st paragraph in section 46-2.01D(2)(a) with:

10-30-15

Performance test ground anchors as described.

Replace the 1st sentence of the 1st paragraph in section 46-2.01D(2)(c) with:

10-30-15

Ground anchors that are performance- or proof-tested must comply with the following:

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 3rd paragraph in section 46-2.03A with:

10-30-15

Sheathe the tendons in the unbonded length with smooth plastic sheathing that extends into the steel tube of the permanent anchorage assembly. Sheathe the tendons full length with corrugated plastic sheathing.

Replace the 7th paragraph in section 46-2.03A with:

10-30-15

Drill the holes for ground anchors in the foundation material deep enough to provide the necessary bonded length beyond the minimum unbonded length shown.

Add between the 13th and 14th paragraphs of section 46-2.03A:

07-19-13

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.

Add between the 1st and 2nd paragraphs of section 46-2.03D:

07-19-13

Secure the ends of strand tendons with a permanent type anchorage system that:

1. Holds the prestressing steel at a force producing a stress of at least 95 percent of the specified ultimate tensile strength of the steel
2. Permanently secures the ends of the prestressing steel

Replace the 2nd sentence of the 1st paragraph of section 46-3.02A with:

07-19-13

The epoxy-coated prefabricated reinforcing bar must comply with section 52-2.03, except the epoxy thickness must be from 10 to 12 mils.

Replace the 2nd paragraph of section 46-3.02B with:

07-19-13

Concrete anchors on bearing plates must comply with the specifications for studs in clause 7 of AWS D1.1.

07-19-13

Delete the 1st paragraph of section 46-3.02E.

^^

47 EARTH RETAINING SYSTEMS

07-18-14

Replace the 2nd paragraph of section 47-2.01D with:

02-17-12

Coupler test samples must comply with minimum tensile specifications for steel wire in ASTM A 82/A 82M. Total wire slip must be at most 3/16 inch when tested under the specifications for tension testing of round wire test samples in ASTM A 370.

Replace "78-80" in the 1st table in the 2nd paragraph of section 47-2.02C with:

10-19-12

78-100

Replace the value for the sand equivalent requirement in the 2nd table in the 3rd paragraph of section 47-2.02C with:

01-20-12

12 minimum

Replace the 1st paragraph of section 47-2.02E with:

07-18-14

Steel wire must comply with the specifications for plain wire reinforcement in ASTM A1064/A1064M. Welded wire reinforcement must comply with the specifications for plain wire welded wire reinforcement in ASTM A1064/A1064M.

Hooks and bends must comply with the *Building Code Requirements for Structural Concrete* published by ACI.

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:

10-19-12

Reinforcement must comply with section 52.

Add to section 47-6.01A:

10-19-12

The alternative earth retaining system must comply with the specifications for the type of wall being constructed.

Replace "sets" at each occurrence in the 1st paragraph of section 47-6.01C with:

04-19-13

copies

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48 TEMPORARY STRUCTURES

07-19-13

Replace "previously welded splice" and its definition in section 48-2.01B with:

04-19-13

previously welded splice: Splice made in a falsework member in compliance with AWS D1.1 or other recognized welding standard before contract award.

Add to section 48-2.01B:

07-19-13

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.

04-19-13

Delete "field" in the 1st sentence of the 5th paragraph of section 48-2.01C(1).

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.

^^

49 PILING

07-18-14

Replace "sets" in the 1st paragraph of section 49-1.01C(2) with:

04-19-13

copies

Replace "set" in the 2nd paragraph of section 49-1.01C(2) with:

04-19-13

copy

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:

07-20-12

"Tensile Load Applied by Hydraulic Jack(s) Acting Upward at One End of Test Beam(s)"

Add to section 49-1.03:

04-20-12

Dispose of drill cuttings under section 19-2.03B.

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.

07-19-13

Delete the 5th paragraph of section 49-2.02B(1)(b).

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

07-19-13

Delete the 3rd paragraph of section 49-2.02C(2).

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

07-19-13

Delete the 1st paragraph of section 49-2.04A(4).

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 between the 3rd and 4th paragraphs of section 49-3.02C(2):

07-18-14

If drilling slurry is used during excavation, maintain the slurry level at least 10 feet above the piezometric head.

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.

Replace item 3 in the list in the 11th paragraph of section 49-3.02C(8) with:

07-18-14

3. Maintain the slurry level at least10 feet above the piezometric head

Add to section 49-4.01:

07-19-13

Steel soldier piles must comply with section 49-2.03.

Replace the headings and paragraphs in section 49-4.02 with:

07-19-13

Concrete anchors must comply with the specifications for studs in clause 7 of AWS D1.1.

^^

50 PRESTRESSING CONCRETE

07-19-13

Replace "sets" at each occurrence in the 2nd and 3rd paragraphs of section 50-1.01C(3) with:

04-19-13

copies

Add to section 50-1.01C(3):

07-19-13

Include a grouting plan with your shop drawing submittal. The grouting plan must include:

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:

07-19-13

Submit test samples for the materials shown in the following table to be used in the work:

Add between "the" and "test samples" in the 1st paragraph of section 50-1.01D(2):

07-19-13

prestressing steel

Replace the 3rd paragraph of section 50-1.01D(2) with:

10-19-12

The Department may verify the prestressing force using the Department's load cells.

Replace the 3rd paragraph in section 50-1.01D(3) with:

07-19-13

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.

Add between the 5th and 6th paragraphs of section 50-1.01D(3):

07-19-13

Each jack and its gages must be calibrated as a unit.

Replace the 6th paragraph in section 50-1.01D(3) with:

07-19-13

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:

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.

07-19-13

Delete the 5th paragraphs of section 50-1.02C.

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

07-19-13

Delete the 2nd sentences in the 1st paragraph of section 50-1.02E.

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.

07-19-13

Delete "at least" in the 1st paragraph of section 50-1.03B(1).

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.

07-19-13

Delete the 1st through 4th paragraphs of section 50-1.03B(2)(a).

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.

Vacuum grouting equipment must consist of:

1. Volumeter for the measurement of void volume
2. Vacuum pump with capacity of at least 10 cfm and equipped with a flow meter capable of measuring the amount of grout being injected

50-1.03B(2)(d)(x) Vertical Tendon Grouting

Provide a standpipe at the upper end of the tendon to collect bleed water and allow it to be removed from the grout. The standpipe must be large enough to prevent the grout elevation from dropping below the highest point of the upper anchorage device. If the grout level drops to the highest point of the upper anchorage device, immediately add grout to the standpipe.

Remove the standpipe after the grout has hardened.

For vertical tendons in excess of 100 feet high or if grouting pressure exceeds 145 psi, inject grout at a higher vent from which grout has already flowed to maintain one-way flow.

50-1.03B(2)(d)(xi) Vents

Place vents at the following locations:

1. Anchorage areas at both ends of the tendon
2. Each high point
3. 4 feet upstream and downstream of each crest of a high point
4. Each change in the cross section of duct

Add to section 50-1.03B(2):

09-16-11

50-1.03B(2)(e) Debonding Prestressing Strands

Where shown, debond prestressing strands by encasing the strands in plastic sheathing along the entire length shown and sealing the ends of the sheathing with waterproof tape.

Distribute the debonded strands symmetrically about the vertical centerline of the girder. The debonded lengths of pairs of strands must be equal.

Do not terminate debonding at any one cross section of the member for more than 40 percent of the debonded strands or 4 strands, whichever is greater.

Thoroughly seal the ends with waterproof tape to prevent the intrusion of water or cement paste before placing the concrete.

^^

51 CONCRETE STRUCTURES

10-30-15

Replace the paragraphs of section 51-1.01A with:

10-19-12

Section 51-1 includes general specifications for constructing concrete structures.

Earthwork for the following concrete structures must comply with section 19-3:

1. Sound wall footings
2. Sound wall pile caps
3. Culverts
4. Barrier slabs
5. Junction structures
6. Minor structures
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:

07-19-13

copies

Replace the 3rd item in the list in the 1st paragraph of section 51-1.01C(4) with:

10-30-15

3. Proposed aggregate gradation

Replace the heading of section 51-1.01D(4) with:

04-19-13

Testing Concrete Surfaces

Add to section 51-1.01D(4)(a):

04-19-13

The Engineer tests POC deck surfaces for smoothness and crack intensity.

Add to the list in the 1st paragraph of section 51-1.01D(4)(b):

04-19-13

3. Completed deck surfaces, including ramps and landings of POCs

Replace the 4th paragraph of section 51-1.01D(4)(b) with:

10-30-15

Except for POCs, surface smoothness is tested using:

1. 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.
2. 12-foot-long straightedge placed transversely to traffic.

For POCs, surface smoothness is tested using:

1. 12-foot-long straightedge placed parallel to the centerline of the POC
2. 6-foot-long straightedge placed perpendicular to the centerline of the POC

Add between the 5th and 6th paragraphs of section 51-1.01D(4)(b):

04-19-13

POC deck surfaces must comply with the following smoothness requirements:

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.

Replace the 11th paragraph of section 51-1.03D(1) with:

10-30-15

If concrete is inaccessible for adequate consolidation by other means, external vibrators must be used and the forms must be sufficiently rigid to resist displacement or damage.

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.

Replace the 1st sentence of the 1st paragraph of section 51-1.03F(5)(a) with:

10-30-15

Construct concrete roadway surfaces of structures, approach slabs, sleeper slabs, and adjoining approach pavement, and concrete decks to be covered with another material, to the grade and cross section 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:

07-18-14

51-1.03F(5)(b)(i) General

Except for bridge widenings, texture roadway surfaces of bridge decks, approach slabs, and sleeper slabs, and other roadway surfaces of concrete structures longitudinally by grinding and grooving or by longitudinal tining.

For bridge widenings, texture the roadway surfaces 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 the 1st sentence of the 2nd paragraph of section 51-2.02C(3) with:

10-30-15

Thoroughly clean contact surfaces and the top surface of the seal to within 1/2 inch from either edge immediately before applying the lubricant-adhesive.

Replace "sets" in the 1st and 2nd paragraphs of section 51-2.02D(1)(c)(ii) with:

04-19-13

copies

Replace "set" in the 7th paragraph of section 51-2.02D(1)(c)(ii) with:

04-19-13

copy

Add to the 1st paragraph of section 51-2.02D(3):

04-19-13

POC deck surfaces must comply with section 51-1.03F(6) before placing and anchoring joint seal assemblies.

Replace "sets" in the 2nd paragraph of section 51-2.02E(1)(c) with:

04-19-13

copies

Replace "set" in the 6th paragraph of section 51-2.02E(1)(c) with:

04-19-13

copy

Replace the 2nd paragraph of section 51-2.02E(1)(e) with:

08-05-11

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.

Replace the 1st sentence of the 6th paragraph of section 51-2.02E(3) with:

10-30-15

Install each assembly with a watertight, continuous return 6 inches up into barriers at the low side of the deck.

Replace "sets" in the 1st and 2nd paragraphs of section 51-2.02F(1)(c) with:

04-19-13

copies

Replace the paragraph in section 51-2.04A(3) with:

10-30-15

Submit a certificate of compliance for waterstop material. The certificate of compliance for PVC waterstop must include a statement that the material complies with Item 6 of Army Corps of Engineers CRD-C 572.

Add between the 1st and 2nd paragraphs of section 51-4.01A:

10-19-12

Prestressing concrete members must comply with section 50.

04-20-12

Delete the 2nd paragraph of section 51-4.01A.

Replace the 3rd paragraph of section 51-4.01C(2) with:

04-20-12

For segmental or spliced-girder construction, shop drawings must include the following additional information:

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:

04-19-13

copies

10-30-15

Delete the 3rd paragraph of section 51-4.01D.

10-19-12

Delete the 1st and 2nd paragraphs of section 51-4.02A.

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.

Replace the paragraph in section 51-5.02G with:

04-18-14

HMA for a temporary roadway structural section must comply with the specifications for minor HMA in section 39.

07-19-13

Delete the 1st paragraph of section 51-5.03B(3).

07-19-13

Delete the 2nd paragraph of section 51-5.03D(1).

Add between the 1st and 2nd paragraphs of section 51-7.01A:

10-19-12

Minor structures include:

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

10-19-12

Delete the 4th paragraph of section 51-7.01A.

Replace the 1st and 2nd paragraphs of section 51-7.01B with:

10-19-12

Concrete must comply with the specifications for minor concrete.

Add to section 51:

10-19-12

51-8–51-15 RESERVED

^^

52 REINFORCEMENT

07-18-14

Add to section 52-1.01A:

07-20-12

Splicing of bar reinforcement must comply with section 52-6.

Replace the 1st and 2nd paragraphs of section 52-1.02B with:

10-19-12

Reinforcing bars must be deformed bars complying with ASTM A 706/A 706M, Grade 60, except you may use:

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 9th paragraph of section 52-1.03D with:

07-18-14

Terminate each unit of spiral reinforcement at both ends by lapping the spiral reinforcement on itself for at least 80 diameters followed by (1) a 135-degree hook with a 6-inch tail hooked around an intersecting longitudinal bar or (2) a mechanical lap splice coupler. Discontinuities in spiral reinforcement may be made only where shown or authorized. The spiral on each side of a discontinuity or a lap splice is a separate unit. Where discontinuities in spiral reinforcement are not allowed, splice the spiral reinforcement. Lap splices in spiral reinforcement must be lapped at least 80 diameters followed by (1) a 135-degree hook with a 6-inch tail hooked around an intersecting longitudinal bar or (2) a mechanical lap splice coupler.

Add to section 52-5.01D:

07-18-14

52-5.01D(4) Quality Assurance Testing

Secure, identify, and transport QA headed bar reinforcement test samples to METS as specified for splice test samples in section 52-5.01D(3)(b).

The Department tests headed bar reinforcement as specified for QC testing in section 52-5.01D(3)(b).

The Department will notify you of the QA test results for each bundle of 4 test samples of splices within 3 business days after METS receives the bundle unless more than 1 bundle is received on the same day, in which case allow 2 additional business days for each additional bundle received.

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

^^

53 SHOTCRETE

10-30-15

Replace the 2nd and 3rd paragraphs of section 53-2.01D(1) with:

10-30-15

Obtain cores for compressive strength testing under ASTM C1604/C1604M. Discard cores that contain bar reinforcement or other obstructions or show evidence of improper coring. Test cores for compressive strength at 28 days under ASTM C1604/C1604M at an authorized laboratory. The compressive strength is the average strength of at least 3 cores that are free from bar reinforcement or other obstructions.

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.

Replace item 2 in the list in the 4th paragraph of section 53-2.01D(3) with:

10-30-15

2. Obtain 3-inch-diameter cores from the test panel.

Replace item 4 in the list in the 4th paragraph of section 53-2.01D(3) with:

10-30-15

4. Test cores for compressive strength. Discard cores that show evidence of improper coring.

Replace the 1st paragraph of section 53-2.01D(4)(a) with:

10-30-15

Obtain at least four 3-inch-diameter test cores from each 50 cu yd, or portion thereof, of shotcrete placed each day. Three cores must be free from reinforcement or obstructions. One core must include reinforcement. The Engineer determines each core location.

Replace the 1st paragraph of section 53-2.01D(4)(b) with:

10-30-15

Each core must be dense and be free of laminations and sand pockets. Any core with reinforcement must show reinforcement or other obstructions completely encased.

10-30-15

Delete the 1st paragraph of section 53-2.01D(4)(c).

Replace "ASTM C42/C42M" in the 5th paragraph of section 53-2.01D(4)(c) with:

10-30-15

ASTM C1604/C1604M

^^

54 WATERPROOFING

10-30-15

Add between "be" and "3/8 inch" in the 3rd paragraph of section 54-4.02C:

04-20-12

at least

Replace the 2nd paragraph of section 54-4.03A with:

10-30-15

Sweep or air blow the concrete surfaces to receive the seal to clean them of dirt, dust, gravel, loose concrete particles, and other extraneous materials. Remove projections and fill depressions that could damage the membrane.

04-18-14

Delete the 3rd paragraph of section 54-5.01A.

04-18-14

Delete "and HMA" in the 2nd paragraph of section 54-5.03.

Replace the last paragraph of section 54-5.03 with:

04-18-14

Do not allow traffic on the seal until HMA is placed over it.

Add to section 54:

07-19-13

54-7 SILANE WATERPROOFING TREATMENT

Reserved

54-8–54-10 RESERVED

^^

55 STEEL STRUCTURES

10-30-15

07-19-13

Delete the 3rd paragraph in section 55-1.01C(1).

Replace the 3rd sentence of the 4th paragraph in section 55-1.01C(1) with:

07-19-13

For ASTM F 1554 anchor bolts, include chemical composition and carbon equivalence for each heat of steel.

Add to section 55-1.01C(1):

07-19-13

For HS connections, submit a record of which lots are used in each joint as an informational submittal.

Replace "sets" at each occurrence in the 1st paragraph of section 55-1.01C(2) with:

04-19-13

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Replace the list in the 2nd paragraph of section 55-1.01C(2) with:

07-19-13

1. Sequence of shop and field assembly and erection. For continuous members, include proposed steel erection procedures with calculations that show girder capacity and geometry will be correct.
2. Welding sequences and procedures.
3. Layout drawing of the entire structure with locations of butt welded splices.
4. Locations of temporary supports and welds.
5. Vertical alignment of girders at each stage of erection.
6. Match-marking diagrams.
7. Details for connections not shown or dimensioned on the plans.
8. Details of allowed options incorporated in the work.
9. Direction of rolling of plates where orientation is specified.
10. Distortion control plan.
11. Dimensional tolerances. Include measures for controlling accumulated error to meet overall tolerances.
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.

07-19-13

Delete the 1st and 2nd sentences in the 3rd paragraph of section 55-1.01C(3).

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.

07-19-13

Delete the 2nd paragraph of section 55-1.01D(1).

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).

10-30-15

Delete the 7th paragraph of section 55-1.01D(3)(b)(i).

Replace item 5 in the list in the 3rd paragraph of section 55-1.01D(3)(b)(ii) with:

10-30-15

5. Assembly must not seize before the final rotation in step 9 is attained.

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]

[a]Grades 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

[a]Use hardened washers.
[b]Zinc-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

[a]Zinc-coated nuts tightened beyond snug or wrench tight must be furnished with a dry lubricant complying with supplementary requirement S2 in ASTM A 563.
[b]Hydrostatic 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 ºF
Grade 50[a] (Thickness up to 2 inches)	15 at 40 ºF
Grade 50W[a] (Thickness up to 2 inches)	15 at 40 ºF
Grade 50[a] (Thickness over 2 inches up to 4 inches)	20 at 40 ºF
Grade 50W[a] (Thickness over 2 inches up to 4 inches)	20 at 40 ºF
Grade HPS 50W[a] (Thickness up to 4 inches)	20 at 10 ºF
Grade HPS 70W (Thickness up to 4 inches)	25 at -10 ºF
Grade 100 (Thickness of 2-1/2 inches or less)	25 at 0 ºF
Grade 100W (Thickness over 2-1/2 inches up to 4 inches)	35 at 0 ºF
Grade HPS 100W (Thickness of 2-1/2 inches or less)	25 at -30 ºF
Grade HPS 100W (Thickness over 2-1/2 inches up to 4 inches)	35 at -30 ºF

[a]If 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.

07-19-13

Delete the 3rd and 4th sentences in the 2nd paragraph in section 55-1.02A(5).

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 of section 55-1.02B(2) with:

10-30-15

Instead of machining, you may heat straighten steel slabs 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 1st paragraph of section 55-1.02B(5) with:

10-30-15

Pins must:

1. Be turned to the dimensions shown
2. Be straight, smooth, and free from flaws
3. Have the final surface produced by a finishing cut

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.

07-19-13

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.

Replace the 3rd paragraph in section 55-1.03C(2) with:

07-19-13

During welding, protect bearings and bearing surfaces using authorized methods.

Replace section 55-1.03C(4) with:

07-19-13

55-1.03C(4) Continuous Members

Unless otherwise shown, structural steel girders are designed for continuity in supporting girder dead load. If erection procedures provide girder continuity for dead load, preassemble members with field joints in a no-load condition in a horizontal or an upright condition.

You may erect structural steel girders such that dead load girder continuity is not provided. If erection procedures do not provide girder continuity for dead load:

1. You may increase cross-sectional areas or change grades of steel to provide the specified capacity if authorized.
2. After erection, the erected structure must have a load-carrying capacity at least equal to the structure shown.

^^

56 SIGNS

10-30-15

Replace the 4th paragraph of section 56-3.01A with:

07-19-13

The types of sign structures include:

1. Truss
2. Bridge mounted
3. Tubular

Replace the subheadings and paragraphs in section 56-3.01C with:

10-30-15

56-3.01C(1) General

Allow 30 days for the Department's review.

56-3.01C(2) Shop Drawings

Submit 2 copies of shop drawings for sign structures. Include:

1. Sign panel dimensions
2. Span lengths

3. Post heights
4. Anchorage layouts
5. Proposed splice locations
6. Snugging and tensioning pattern for anchor bolts and HS bolted connections
7. Details for permanent steel anchor bolt templates
8. Details of clips, eyes, or removable devices for preventing damage to the finished galvanized or painted surfaces used for:
   8.1 Securing the sign during shipping
   8.2 Lifting and moving during erection

56-3.01C(3) Quality Control Program

Submit a QC program for sign structures. Include methods, equipment, and personnel to be used during fabrication and installation.

Submit the QC program with the shop drawing submittal.

Replace "sets" in the 1st paragraph of section 56-3.01C(2) with:

04-19-13

copies

Replace the 1st and 2nd paragraphs of section 56-3.01D(2)(b) with:

10-30-15

For UT of welded joints with any members less than 5/16 inch thick or tubular sections less than 13 inches in diameter, the acceptance and repair criteria must comply with Clause 6.13.3.1 of AWS D1.1.

For UT of other welded joints, the acceptance and repair criteria must comply with Table 6.3 of AWS D1.1 for cyclically loaded nontubular connections.

Replace the 4th paragraph of section 56-3.02B with:

10-30-15

Structural tubing and hollow structural sections must be structural steel complying with ASTM A500/A500M, Grade B or ASTM A1085.

07-20-12

Delete the 7th paragraph of section 56-3.02K(2).

Replace the 1st paragraph of section 56-3.02M(1) with:

07-19-13

Galvanize all ferrous metal parts of the following sign structure types:

1. Truss
2. Bridge mounted
3. Tubular

Add between the 1st and 2nd paragraphs of section 56-3.02M(1):

04-19-13

Clean and paint all ferrous metal parts of tubular sign structures after galvanizing, including the areas to be covered by sign panels. Do not paint sign structures other than tubular type unless specified in the special provisions.

Replace the headings and paragraphs in section 56-3.02M(3) with:

04-19-13

Where specified, clean and paint sign structures under section 59-5.

^^

57 WOOD AND PLASTIC LUMBER STRUCTURES

10-30-15

Replace the 2nd and 3rd paragraphs of section 57-2.01B(2) with:

10-30-15

Structural timber and lumber must be inspected and grade marked under the rules and specifications shown in the following table:

Replace the 9th paragraph of section 57-2.01B(2) with:

10-30-15

Glued laminated timbers must comply with ANSI/AITC A190.1 and AITC 117, published by the American Institute of Timber Construction.

10-30-15

Delete the 2nd and 4th paragraphs of section 57-2.01B(3).

Replace "51-2.01C(3)" in the 1st paragraph of section 57-2.01C(3)(a) with:

10-19-12

57-2.01C(3)

Add to section 57-2.01C(3)(a):

10-30-15

Treated timber must be preservative-treated Douglas fir or Hem-fir. Chromated copper arsenate must not be used for preservative treatment.

Add to section 57-2.02B:

10-30-15

Chromated copper arsenate must not be used for preservative treatment.

Replace the 2nd sentence of the 1st paragraph of section 57-2.03B(3) with:

10-30-15

The wire rope must be furnished with Class A weight zinc-coated wire under ASTM A603.

Replace "sets" at each occurrence in the 1st paragraph of section 57-3.01C with:

04-19-13

copies

^^

58 SOUND WALLS

04-19-13

10-19-12

Delete the 3rd paragraph of section 58-1.01.

Replace the 1st paragraph of section 58-2.01D(5)(a) with:

08-05-11

You must employ a special inspector and an authorized laboratory to perform Level 1 inspections and structural tests of masonry to verify the masonry construction complies with section 1704, "Special Inspections," and section 2105, "Quality Assurance," of the 2007 CBC.

10-19-12

Delete the 1st paragraph of section 58-2.02F.

Replace "sets" at each occurrence in the 1st paragraph of section 58-4.01C with:

04-19-13

copies

^^

59 PAINTING

11-15-13

Replace "SSPC-SP 10" at each occurrence in section 59 with:

10-19-12

SSPC-SP 10/NACE no. 2

Replace "SSPC-SP 6" at each occurrence in section 59 with:

10-19-12

SSPC-SP 6/NACE no. 3

Replace "SSPC-CS 23.00" at each occurrence in section 59 with:

10-19-12

SSPC-CS 23.00/AWS C 2.23M/NACE no. 12

Replace "*Specification for Structural Joints Using ASTM A325 or A 490 Bolts*" in the 1st paragraph of section 59-2.01C(1) with:

07-19-13

Specification for Structural Joints Using High-Strength Bolts

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:

10-19-12

AISC-420-10/SSPC-QP 3 (Enclosed Shop)

Replace "*Specification for Structural Joints Using ASTM A325 or A 490 Bolts*" in the 1st paragraph of section 59-2.02 with:

07-19-13

Specification for Structural Joints Using High-Strength Bolts

Replace the paragraphs in section 59-2.03A with:

10-19-12

Clean and paint all exposed structural steel and other metal surfaces.

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

[a]If no finish coats are described, a final coat of inorganic zinc primer is required.
[b]Exterior grade latex must comply with section 91-2.02 unless otherwise specified.
[c]Includes 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

[a]Includes 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:

1. Identify and obtain authorization for the areas to be stained
2. Remove oils, dirt, and other contaminants from the surfaces to be stained
3. Dry all surfaces to be stained

59-12.03C Application

After the areas to be stained have been identified, prepared, and the test plot authorized, stain the exposed surfaces under the manufacturer's instructions to achieve a color consistent with, or as close as possible to, the authorized test area color.

Control overspray and protect adjacent surfaces.

Keep stained surfaces dry for at least 20 days following the application of the stain.

59-12.04 PAYMENT

Rock stain areas are measured along the slope face.

^^^

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

^^

68 SUBSURFACE DRAINS

04-18-14

Replace the 5th paragraph of section 68-4.02E with:

04-18-14

HMA for backfilling trenches must comply with HMA for miscellaneous areas as specified in section 39.

^^

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.

Add to section 70:

07-19-13

70-8–70-15 RESERVED

^^^

Replace the row under "Rock class" in the table in the 2nd paragraph of section 72-3.03E with:

01-20-12

1/2 T	1/4 T	Light	Facing	Cobble

07-19-13

Delete the 5th and 6th paragraphs of section 72-11.01B.

Add to section 72-11.01B:

01-18-13

Expanded polystyrene and premolded expansion joint filler must comply with section 51-2.

07-19-13

Delete the 2nd paragraph of section 72-11.01C(1).

07-19-13

Delete the 7th paragraph of section 72-11.01C(1).

Add between the 7th and 8th paragraphs of section 72-11.01C(1):

07-19-13

Schedule the construction of the slope paving such that the work, including placing and finishing concrete and applying curing compound, is completed on the same day that the work is started.

Replace the 8th paragraph of section 72-11.01C(1) with:

07-19-13

If the Engineer determines that the size of the slope paving is too large to be constructed without an intermediate construction joint, place a joint at an authorized location. Complete a section of concrete bounded by permissible construction joints within the same day.

Replace the 1st paragraph of section 72-11.01C(2) with:

01-18-13

Construct and finish minor concrete slope paving under section 51-1.

Replace the 3rd paragraph of section 72-11.01C(2) with:

07-19-13

After striking-off to grade, hand float the concrete with floats that are at least 4 inches wide and 30 inches long. Broom the entire surface with a stiff-bristled broom to produce a uniform surface. Brooming must be done when the surface is sufficiently set to prevent deep scarring and must be accomplished by drawing the broom down the slope, leaving marks parallel to the slope. The Engineer may order you to apply a fine spray of water to the surface immediately before brooming.

07-19-13

Delete the 3rd paragraph of section 72-11.01D.

^^

73 CONCRETE CURBS AND SIDEWALKS

07-19-13

Replace the paragraph in section 73-1.01A with:

07-19-13

Section 73-1 includes general specifications for constructing minor concrete items including concrete curbs, sidewalks, gutter depressions, driveways, island paving, and curb ramps; for installing detectable warning surfaces and precast parking bumpers; and for texturing and coloring concrete surfaces.

^^

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.

^^

75 MISCELLANEOUS METAL

10-30-15

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 the 7th paragraph of section 75-1.03F with:

10-30-15

Before applying any nonskid material, demonstrate the method of application to the Engineer by preparing a 1-sq ft test sample applied on hardboard at least 1/4 inch thick. The nonskid surface must have a total thickness from 1/8–3/16 inch.

Replace "metal beam guard railing" in the table in the 1st paragraph of section 75-1.05 with:

07-19-13

guardrail

^^

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

^^

80 FENCES

07-18-14

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 mesh and wire will be exerted. Terminate the wire mesh and barbed wire at each end, corner, pull, and gate post in the new fence line. Attach wire mesh and barbed wire to each wood or steel end, corner, pull, or gate post by wrapping each horizontal strand around the post and tying it back on itself with at least 4 tightly-wound wraps.

At line posts, fasten the wire mesh to the post at the top and bottom and at intermediate points not exceeding 10 inches apart. Fasten each line of barbed wire to each line post. Use wire ties or clips to fasten the wires to metal posts under the post manufacturer's instructions. Drive staples crosswise with the grain of the wood and pointed slightly downward. Drive staples just short of actual contact with the wires to allow free longitudinal movement of those wires and to prevent damage to the wire's protective coating. Secure all wires to posts to maintain horizontal alignment.

Splices in barbed wire and wire mesh are allowed provided there are no more than 2 splices per 50 feet of fence. Use commercially-available galvanized mechanical wire splices or a wire splice created by tying off wire. Install mechanical wire splices with a tool designed for that purpose under the manufacturer's instructions. Tie off the wire as follows:

1. Carry the ends of each wire 3 inches past the tied-off knot location and wrap around the wire for at least 6 turns in opposite directions.
2. Remove the splice tool and close the space by pulling the end of the wires together.
3. Cut the unused ends of the wire close and neat.

07-18-14

Delete "resisting moment" and its definition in section 80-3.01B.

Add to section 80-3.01B:

07-18-14

posts and braces: Framework that supports the metal fabric for chain link fence. Posts and braces include round and roll-formed cross sections used as line, end, latch, or corner posts and braces.

Add to section 80-3.01C:

07-18-14

Submit a certificate of compliance for posts and braces that includes the information specified in ASTM F1043, section 9.

07-18-14

Delete section 80-3.01D.

Replace the 1st paragraph of section 80-3.02B with:

07-18-14

The base metal for posts and braces must be commercial-quality, weldable steel complying with AASHTO M 181, Type 1, except for the protective coating requirements.

Posts and braces must comply with the strength requirements in ASTM F1043:

1. Group IA, regular grade, for round posts
2. Group II-L for roll-formed posts and braces

07-18-14

Delete the 4th through 8th paragraphs of section 80-3.02B.

Add between "coating" and "unless" in the 1st sentence of section 80-3.02C:

07-18-14

or ASTM F1345, Class 2,

^^^

Add between "splices at" and "posts" in the 5th paragraph of section 83-1.02B:

07-19-13

midspan between

Replace the 7th paragraph of section 83-1.02B with:

10-30-15

Construct midwest guardrail system using:

1. Wood or steel line posts.
2. Wood blocks for line posts. You may use plastic blocks for steel line posts where shown.
3. Only 1 type of post and block for any 1 continuous length of guardrail.

Replace the 9th paragraph of section 83-1.02B with:

10-30-15

Submit 2 certified copies of mill test reports as an informational submittal for each heat of steel from which the steel posts are formed or fabricated.

10-30-15

Delete "chromated copper arsenate," in the 1st sentence of the 14th paragraph of section 83-1.02B.

Replace "7th paragraph in section 57-2.01B(3)" in the 16th paragraph of section 83-1.02B with:

10-30-15

1st and 2nd paragraphs in section 57-2.01C(3)(b)

Replace "Metal rail posts, box spacers, and" in item 1 in the list in the 25th paragraph of section 83-1.02B with:

07-19-13

Metal box spacers and

Replace item 4 in the list in the 25th paragraph of section 83-1.02B with:

07-18-14

4. For the connection of guard railing to new bridge railing or barriers, anchor bolt holes must be drilled in the concrete parapet or formed using metal or PVC sleeves.

07-19-13

Delete items 6 and 7 in the list in the 25th paragraph of section 83-1.02B.

10-30-15

Delete "A 441," in item 5 in the list in the 26th paragraph of section 83-1.02B:

Add between "mixture" and "specified" in the 27th paragraph of section 83-1.02B:

10-30-15

for load bearing applications

Replace "Type WB" at each occurrence in section 83-1.02B(2) with:

07-19-13

Type WB-31

Replace "metal" at each occurrence in the 2nd paragraph of section 83-1.02B(2) with:

10-30-15

rail

Replace the heading of section 83-1.02B(3) with:

07-19-13

Temporary Midwest Guardrail System

Replace the 2nd sentence of the 9th paragraph of section 83-1.02D(1) with:

07-18-14

Posts and balusters must be normal to the profile grade. Transverse to the profile grade, railings must be plumb within a tolerance not to exceed 0.02 foot in 10 feet.

Replace "80-2.02" in the 2nd paragraph of section 83-1.02E with:

10-19-12

80-3.02B

Replace the 3rd paragraph of section 83-1.02G(2) with:

07-18-14

Stud bolts must comply with the specifications for studs in clause 7 of AWS D1.1.

Replace the 7th paragraph of section 83-1.02G(2) with:

10-30-15

For tubular hand railing and tubular lower rail mounted on Type 80SW concrete barrier:

1. Resin capsule anchors and threaded rods must comply with section 75-1.03
2. Drilling and bonding threaded rods must comply with the specifications for drilling and bonding dowels in section 51-1

Replace "horizontal" in the 8th paragraph of section 83-1.02G(2) with:

07-18-14

vertical

Replace the 10th paragraph of section 83-1.02G(2) with:

10-30-15

For tubular handrailings on Type 80SW concrete barriers, submit 2 copies of threaded rod layouts before placing barrier reinforcement.

10-30-15

Delete the 15th paragraph of section 83-1.02I.

Replace the 1st sentence of the 1st paragraph of section 83-1.03 with:

11-15-13

Except for guardrail within the pay limits of a terminal system, a transition railing (Type WB-31), an end anchor assembly, or a rail tensioning assembly, midwest guardrail system is measured along the face of the rail element from end post to end post of the completed railing.

Add between the 1st and 2nd paragraphs of section 83-2.01:

10-30-15

Concrete barrier work includes:

1. Bar reinforcing steel, including the length that extends from the barrier into decks, walls, and footings
2. Constructing steel plate barriers at overhead sign foundations, electroliers, drainage structures, and other locations shown

10-30-15

Delete the 2nd paragraph of section 83-2.01.

Replace "Reserved" in section 83-2.02A with:

10-30-15

Markers must comply with section 82.

Replace the 4th paragraph of section 83-2.02B with:

10-30-15

Use wood blocks with wood and steel posts. You may use plastic blocks with steel posts where shown.

Replace the 7th paragraph of section 83-2.02B with:

10-30-15

Threaded rods must comply with ASTM A 307. Anchor bolts must comply with ASTM F 1554, Grade 55.

Add between the 8th and 9th paragraphs of section 83-2.02B:

10-30-15

Trim existing median plantings to clear the work area for thrie beam barrier construction. Dispose of trimmings.

Replace "metal" at each occurrence in the 3rd paragraph of section 83-2.02B(2) with:

10-30-15

rail

Add between "roadway" and ", except" in the 4th paragraph of section 83-2.02B(2):

10-30-15

at authorized locations

Replace the 15th paragraph of section 83-2.02D(1) with:

10-30-15

The tubular handrailing and tubular lower rail for Type 80SW concrete barrier must comply with the specifications for tubular handrailing in section 83-1.02G(2).

Add to section 83-2.02D(1):

10-21-11

For a concrete barrier transition:

1. Remove portions of the existing concrete barrier where shown under section 15-3
2. Roughen the contact surface of the existing concrete barrier
3. Drill and bond dowels into the existing concrete barrier under section 51-1

Replace the 1st paragraph of section 83-2.02D(2) with:

10-30-15

Construct Type 50 and 60 series concrete barriers of minor concrete, except as follows:

1. Concrete must contain not less than 550 pounds of cementitious material per cubic yard.
2. Maximum size of aggregate used for extruded or slip formed concrete barrier must be no larger than 1-1/2 inches and no smaller than 3/8 inch.
3. If the 3/8-inch maximum size aggregate grading is used to construct extruded or slip formed concrete barrier, the concrete must contain not less than 675 pounds of cementitious material per cubic yard.

Replace the 2nd paragraph of section 83-2.02D(2) with:

10-30-15

In non-freeze-thaw areas, concrete for concrete barriers other than Type 50 and 60 series must contain not less than 590 pounds of cementitious material per cubic yard.

Add to section 83-2.02:

10-19-12

83-2.02H–83-2.02M Reserved

Add between the 2nd and 3rd paragraphs of section 83-2.03:

10-30-15

The payment quantity for single thrie beam barrier is the length measured from end post to end post along the face of the rail element of the installed barrier. The quantity does not include any portion of single thrie beam barrier within the pay limits of transition railing (Type STB).

Add to the end of the 4th paragraph of section 83-2.03:

10-30-15

The quantity does not include any portion of double thrie beam barrier within the pay limits of transition railing (Type DTB).

Replace the 10th paragraph of section 83-2.03 with:

10-30-15

The payment quantity for concrete barriers includes the length of gaps in the concrete barrier where steel plate barrier is attached to the concrete barrier.

^^

84 TRAFFIC STRIPES AND PAVEMENT MARKINGS

05-30-14

Replace section 84-1.01C with:

05-30-14

84-1.01C Submittals

For glass beads used in drop-on applications and in thermoplastic formulations, submit a certificate of compliance and test results for each lot of beads specifying the EPA test methods used and tracing the lot to the specific test sample. The testing for lead and arsenic content must be performed by an independent testing laboratory.

Submit retroreflectivity readings for traffic stripes and pavement markings at locations with deficient retroreflectivity determined by the Engineer.

84-1.01D Quality Control and Assurance

Test each lot of glass beads for arsenic and lead under EPA Test Method 3052 and 6010B or 6010C.

Applied traffic stripes and pavement markings must be retroreflective. Within 30 days of applying traffic stripes and pavement markings, the retroreflectivity of the stripes and markings must be a minimum of 250 $mcd \cdot m^{-2} \cdot lx^{-1}$ for white and 125 $mcd \cdot m^{-2} \cdot lx^{-1}$ for yellow when measured under ASTM E1710.

The Engineer will perform a nighttime, drive-through, visual inspection of the retroreflectivity of the traffic stripes and pavement markings and notify you of any locations with deficient retroreflectivity. Measure the retroreflectivity of the deficient areas using a retroreflectometer under ASTM E1710 and the sampling protocol specified in ASTM D7585.

Replace the paragraph in section 84-1.02 with:

05-30-14

Glass beads applied to paint must comply with State Specification 8010-004.

Glass beads applied to molten thermoplastic material must be Type 2 beads complying with AASHTO M 247. The glass beads must have a coating that promotes adhesion of the beads to thermoplastic.

At least 75 percent of the beads by count must be true spheres that are colorless and do not exhibit dark spots, air inclusions, or surface scratches when viewed under 20X magnification.

Each lot of glass beads used in pavement markings must contain less than 200 ppm each of arsenic and lead when tested under EPA Test Method 3052 and 6010B or 6010C.

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

^^

86 ELECTRICAL SYSTEMS

10-17-14

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

25×10^{13} Ω per inch, minimum

Add between "the" and "head" in the 3rd sentence of the 2nd paragraph of 86-2.09F:

07-19-13

connector

Replace "project" in the 3rd paragraph of section 86-2.11A with:

10-19-12

work

Replace "Contract" in item 2 in the list in the 11th paragraph of section 86-2.11A with:

10-19-12

work

07-19-13

Delete the 12th paragraph of section 86-2.11A.

Replace section 86-2.11C with:

07-19-13

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.

Replace section 86-2.14A with:

07-19-13

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.

Replace the 2nd paragraph of section 86-3.02A(1) with:

07-19-13

The Department furnishes the BBS components under section 6-2.03.

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

07-19-13

Delete item 1.3 in the list in the 7th paragraph of section 86-3.04A.

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.

07-19-13

Delete item 1 in the list in section 86-4.01D(1)(b).

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:

07-19-13

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.

Replace the heading of section 86-4.02 with:

07-19-13

PROGRAMMED VISIBILITY VEHICLE SIGNAL SECTION

Replace "face" in the 1st paragraph of section 86-4.02 with:

07-19-13

section

Add before the 1st sentence in section 86-4.03A:

07-19-13

The pedestrian signal face must be Type A.

Replace the 1st sentence of the 2nd paragraph of section 86-4.03B with:

07-19-13

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).

Replace the paragraphs of section 86-4.03I(1)(c)(i) with:

07-19-13

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.

Replace item 1 in the list in the 1st paragraph of section 86-4.03I(2) with:

07-19-13

1. Not include reflectors.

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)

Replace the paragraphs in section 86-4.03J with:

10-17-14

Reserved

Add between "beacon" and "must" in the 1st sentence of section 86-4.05:

07-19-13

signal face

07-19-13

Delete "face" in item 1 in the list in the 1st paragraph of section 86-4.05.

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

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 section 86-5.02 with:

07-19-13

86-5.02 PUSH BUTTON ASSEMBLIES

The housing for a push button assembly must be die-cast or permanent mold-cast aluminum. The assembly must be rainproof and shockproof in any weather condition.

The push button's switch must be a single-pole, double-throw switching unit with screw-type terminals rated 15 A at 125 V(ac). The switch must have:

1. Plunger actuator and a U frame to allow recessed mounting in the push button housing
2. Operating force of 3.5 lb
3. Maximum pretravel of 5/64 inch
4. Minimum overtravel of 1/32 inch
5. Differential travel from 0.002 to 0.04 inch
6. 2-inch minimum diameter actuator

Where a push button is attached to a pole, the housing must be shaped to fit the pole's curvature. Use saddles if needed to make a neat and secure fit.

Where a push button is mounted on top of a 2-1/2-inch-diameter post, fit the housing with a slip fitter and use screws to rigidly secure it to the post.

Install the push button and the sign on the crosswalk side of the pole.

Attach the sign on a Type B push button assembly.

For a Type C push button assembly, mount the instruction sign on the same standard as the assembly using 2 straps and saddle brackets.

Add to section 86-5:

07-19-13

86-5.03 ACCESSIBLE PEDESTRIAN SIGNAL

Reserved

Replace "lthe amp" in item 2 in the list in the 1st paragraph of section 86-6.01A(2) with:

07-19-13

the lamp

^^^

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

[a]Machine direction x cross direction
[b]Geosynthetic 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

^^

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

[a]Percent 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.
[b]Electronically actuated moisture meter must be calibrated once per week per ASTM C566.

Concrete QC Tests

Property	Test method	Minimum testing frequency
Compressive strengthb	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

[a]ASTM C173/C173M must be used for lightweight concrete.
[b]Cylinders 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.

For PC concrete that is steam cured, concrete designated by compressive strength is acceptable if its compressive strength reaches the described 28-day compressive strength in no more than the maximum number of days specified or allowed after the concrete is cast.

90-4.01D(3) Quality Assurance

For PC concrete that is steam cured, the Engineer evaluates the compressive strength based on individual tests representing specific portions of production.

Add between the 1st and 2nd paragraphs of section 90-4.02:

07-19-13

PC portland cement based repair material must be on the Authorized Material List.

If municipally supplied potable water is used for PC concrete, the testing specified in section 90-1.02D is waived unless requested.

Add to section 90-4.03:

07-19-13

For dimensional tolerances of PC concrete members, comply with the Precast/Prestressed Concrete Institute Concrete Institute's *Tolerance Manual for Precast and Prestressed Concrete Construction, MNL 135-00*.

For tier 1 and tier 2 PC concrete members, apply curing compound using power-operated spraying equipment. You may request application by hand spraying for small quantities of PC concrete members. For tier 3 and tier 4 PC concrete members, the application of curing compound may be hand sprayed.

Replace the item 2 in the list in the 2nd paragraph of section 90-4.03 with:

07-19-13

2. To prevent moisture loss on the exposed surfaces during the presteaming period, cover the concrete as soon as possible after casting or keep the exposed surfaces wet by fog spray, curing compound, or wet blankets.

^^

91 PAINT

10-19-12

Add to section 91-2:

10-19-12

91-2.03 MOISTURE-CURED POLYURETHANE COATING

Reserved

Replace "saint" in the 1st paragraph of section 91-4.05 with:

10-19-12

paint

^^

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, ℃	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

[a]The Department allows ASTM D 5546 or ASTM D 7753 instead of AASHTO T 44. Particles recovered from ASTM D 5546 or ASTM D 7753 or AASHTO T 44 must be less than 250 µm.
[b]Report only for spray application.
[c]The Engineer waives this specification if the supplier provides written certification the asphalt can be adequately pumped and mixed at temperatures meeting applicable safety standards.
[d]"RTFO Test" means the asphaltic residue obtained using the Rolling Thin Film Oven Test, AASHTO Test Method T 240 or ASTM D 2872. The residue from mass change determination may be used for other tests.
[e]Test temperature is the temperature at which G*/sin(delta) is 2.2 kPa. A graph of log G*/sin(delta) plotted against temperature may be used to determine the test temperature when G*/sin(delta) is 2.2 kPa. A graph of (delta) versus temperature may be used to determine delta at the temperature when G*/sin(delta) is 2.2 kPa. The graph must have at least two points that envelope G*/sin(delta) of 2.2 kPa and the test temperature must not be more than 6 degree C apart. The Engineer also accepts direct measurement of (delta) at the temperature when G*/sin(delta) is 2.2 kPa.
[f]Tests without a force ductility clamp may be performed.
[g]"PAV" means "Pressure Aging Vessel."

Do not modify PG modified asphalt binder using polyphosphoric acid.

Crumb rubber must be from automobile and truck tires and must be free from contaminants including fabric, metal, minerals, and other nonrubber substances.

PG modified asphalt binder modified with crumb rubber must be homogeneous and must not contain visible particles of crumb rubber.

The supplier of PG modified asphalt binder modified with crumb rubber must:

1. Report the amount of crumb rubber by weight of asphalt binder
2. Certify a minimum of 10 percent of crumb rubber by weight of asphalt binder

^^

93 LIQUID ASPHALTS

07-19-13

Replace "Celsius" the 1st row in the table in the 8th paragraph of section 93-1.04 with:

07-19-13

Fahrenheit

^^

94 ASPHALTIC EMULSIONS

03-21-14

Replace the 1st paragraph of section 94-1.04 with:

03-21-14

Asphaltic emulsion is measured by weight under the specifications requiring its use. If water is added to the asphaltic emulsion, the quantity of asphaltic emulsion is determined before the addition of water.