



STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION

**NOTICE TO BIDDERS  
AND  
SPECIAL PROVISIONS**

FOR CONSTRUCTION ON STATE HIGHWAY IN LOS ANGELES AND ORANGE  
COUNTIES IN BUENA PARK, LA MIRADA, CERRITOS AND SANTA FE  
SPRINGS FROM ARTESIA BOULEVARD UNDERCROSSING TO NORTH FORK  
COYOTE CREEK

In District 07 On Route 5

Under

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*Bid book dated March 7, 2016*

*Standard Specifications dated 2010*

Project plans approved January 25, 2016

*Standard Plans dated 2010*

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Identified by

Contract No. 07-2159U4

07-LA,Ora-5-0.0/1.5, 44.3/44.4

Project ID 0715000160

Federal-Aid Project

ACNHPI-005-2(981)N

DEMO06-6207(062)N

**Electronic Bidding Contract**

Bids open Wednesday, April 27, 2016

Dated March 7, 2016

XS  
AADD  
OSD  
IH



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# SPECIAL NOTICES

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

# CONTRACT No. 07-2159U4

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

## HIGHWAYS

Richard Chiang  
REGISTERED CIVIL ENGINEER

5/12/15  
DATE



## ELECTRICAL

Jesse Ruelas  
REGISTERED ELECTRICAL ENGINEER

01/26/16  
DATE



## MAINTAINING TRAFFIC

D. S. Katayama  
REGISTERED CIVIL ENGINEER

1/26/16  
DATE



## LANDSCAPE

George Olguin  
LICENSED LANDSCAPE ARCHITECT

5/12/15  
DATE



## STRUCTURES

Xiahong Li  
REGISTERED CIVIL ENGINEER

1/26/2016  
DATE



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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 A10F	Legend - Soil (Sheet 1 of 2)
RSP A10G	Legend - Soil (Sheet 2 of 2)
A10H	Legend - Rock
A20A	Pavement Markers and Traffic Lines, Typical Details
A20B	Pavement Markers and Traffic Lines, Typical Details
RSP A20C	Pavement Markers and Traffic Lines, Typical Details
A20D	Pavement Markers and Traffic Lines, Typical Details
RSP A24A	Pavement Markings - Arrows
A24B	Pavement Markings - Arrows and Symbols
RSP A24C	Pavement Markings - Symbols and Numerals
A24D	Pavement Markings - Words
RSP A24E	Pavement Markings - Words, Limit and Yield Lines
RSP A24F	Pavement Markings - Crosswalks
A62A	Excavation and Backfill - Miscellaneous Details
A62B	Limits of Payment for Excavation and Backfill - Bridge Surcharge and Wall
A62C	Limits of Payment for Excavation and Backfill - Bridge
A62D	Excavation and Backfill - Concrete Pipe Culverts
RSP A62F	Excavation and Backfill - Metal and Plastic Culverts
A73A	Object Markers
A73B	Markers
A73C	Delineators, Channelizers and Barricades
A74	Survey Monuments
RSP A76A	Concrete Barrier Type 60
A76B	Concrete Barrier Type 60
A76D	Concrete Barrier Type 60G

A76E	Concrete Barrier Type 60G
A76F	Concrete Barrier Type 60GE
A76G	Concrete Barrier Type 60S
A76H	Concrete Barrier Type 60S
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 A77P1	Midwest Guardrail System Typical Layouts for Embankments
RSP A77Q1	Midwest Guardrail System Typical Layouts for Structure Approach
RSP A77R2	Midwest Guardrail System Typical Layouts for Fixed Objects Between Separate Roadbeds (One-Way Traffic)
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 A77U3	Midwest Guardrail System Connections to Abutments and Walls
RSP A85	Chain Link Fence
A85A	Chain Link Fence Details
RSP A85B	Chain Link Fence Details
RSP A87A	Curbs and Driveways
RSP A87B	Hot Mix Asphalt Dikes
RSP A88A	Curb Ramp Details
RSP A88B	Curb Ramp and Island Passageway Details
RSP P1	Jointed Plain Concrete Pavement New Construction
RSP P2	Jointed Plain Concrete Pavement (Widened Lane) New Construction
RSP P6	Spall Repair
RSP P10	Concrete Pavement Dowel Bar Details
RSP P12	Concrete Pavement Dowel Bar Basket Details
RSP P15	Concrete Pavement - Tie Bar Details
RSP P17	Concrete Pavement Tie Bar Basket Details
RSP P18	Concrete Pavement Lane Schematics and Isolation Joint Detail
RSP P20	Joint Seals

RSP P30	Concrete Pavement - End Panel Pavement Transitions
P35	Concrete Pavement - Ramp Transition Paving Details
P45	Concrete Pavement - Drainage Inlet Details No. 1
P46	Concrete Pavement - Drainage Inlet Details No. 2
P70	Hot Mix Asphalt Paving (Longitudinal Tapered Notched Wedge Joint)
D71	Drainage Inlet Markers
D72	Drainage Inlets
RSP D73	Drainage Inlets
D73A	Drainage Inlets (Precast)
D74A	Drainage Inlets
RSP D74B	Drainage Inlets
D74C	Drainage Inlet Details
RSP D77A	Grate Details No. 1
RSP D77B	Grate Details No. 2
D78A	Gutter Depressions
D94B	Concrete Flared End Sections
RSP D99A	Pavement Structure - Drainage System Details
RSP D99B	Edge Drain Outlet and Vent Details
RSP D99C	Edge Drain Cleanout and Vent Details
RSP D99D	Cross Drain Interceptor Details
D100A	Gabion Basket Details No. 1
D100B	Gabion Basket Details No. 2
D102	Underdrains
RSP H1	Landscape and Erosion Control Abbreviations
RSP H2	Landscape and Erosion Control Symbols
H3	Landscape Details
RSP H4	Landscape Details
RSP H5	Landscape Details
RSP H6	Landscape Details
RSP H7	Landscape Details
RSP H8	Landscape Details
RSP H9	Landscape Details
RSP H9A	Landscape Details
H10	Irrigation Controller Enclosure Cabinet
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)
T4	Temporary Traffic Screen
T5	Temporary Terminal Section (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
RSP T11	Traffic Control System for Lane Closure on Multilane Conventional Highways
RSP T13	Traffic Control System for Lane Closure on Two Lane Conventional Highways
RSP T14	Traffic Control System for Ramp Closure
RSP T15	Traffic Control System for Moving Lane Closure on Multilane Highways
RSP T16	Traffic Control System for Moving Lane Closure on Multilane Highways
T51	Temporary Water Pollution Control Details (Temporary Silt Fence)
T53	Temporary Water Pollution Control Details (Temporary Cover)
T54	Temporary Water Pollution Control Details (Temporary Erosion Control Blanket)
T56	Temporary Water Pollution Control Details (Temporary Fiber Roll)
T58	Temporary Water Pollution Control Details (Temporary Construction Entrance)
T59	Temporary Water Pollution Control Details (Temporary Concrete Washout Facility)
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)
B0-1	Bridge Details
B0-3	Bridge Details
B0-5	Bridge Details
B0-13	Bridge Details
B2-3	16" and 24" Cast-In-Drilled-Hole Concrete Pile
B2-5	Pile Details - Class 90 and Class 140
B2-8	Pile Details - Class 200
RSP B3-1A	Retaining Wall Type 1 (Case 1)
RSP B3-4A	Retaining Wall Type 5 (Case 1)
RSP B3-5	Retaining Wall Details No. 1
B3-6	Retaining Wall Details No. 2

RSP B6-21	Joint Seals (Maximum Movement Rating = 2")
B7-1	Box Girder Details
B7-6	Deck Drains - Types D-1 and D-2
B7-7	Deck Drain - Type D-3
B7-8	Deck Drainage Details
B7-10	Utility Opening - Box Girder
RSP B8-5	Cast-In-Place Post-Tensioned Girder Details
B11-7	Chain Link Railing
B11-51	Tubular Hand Railing
RSP B11-54	Concrete Barrier Type 26
RSP B11-56	Concrete Barrier Type 736
B14-3	Communication and Sprinkler Control Conduits (Conduit Less Than 4")
B14-4	Water Supply Line (Bridge) (Pipe Sizes Less Than 4")
B14-5	Water Supply Line (Details) (Pipe Sizes Less Than 4")
RS1	Roadside Signs, Typical Installation Details No. 1
RS2	Roadside Signs - Wood Post, Typical Installation Details No. 2
RSP RS3	Roadside Signs - Laminated Wood Box Post Typical Installation Details No. 3
RS4	Roadside Signs, Typical Installation Details No. 4
RSP S1	Overhead Signs - Truss, Instructions and Examples
RSP S2	Overhead Signs - Truss, Single Post Type - Post Types II thru IX
S3	Overhead Signs - Truss, Single Post Type - Base Plate and Anchorage Details
S4	Overhead Signs - Truss, Single Post Type - Structural Frame Members Details No. 1
S5	Overhead Signs - Truss, Single Post Type - Structural Frame Members Details No. 2
S6	Overhead Signs - Truss, Gusset Plate Details
S8	Overhead Signs - Truss, Single Post Type - Round Pedestal Pile Foundation
S12	Overhead Signs - Truss, Structural Frame Details
S13	Overhead Signs - Truss, Frame Juncture Details
S16	Overhead Signs - Walkway Details No. 1
RSP S17	Overhead Signs - Walkway Details No. 2
RSP S17A	Overhead Signs - Walkway Details No. 3
S18	Overhead Signs - Walkway Safety Railing Details
S19	Overhead Signs - Truss, Sign Mounting Details - Laminated Panel - Type A
S20	Overhead Signs - Steel Frames - Removable Sign Panel Frames
S21	Overhead Signs - Removable Sign Panel Frames Mounting Details

S22	Overhead Signs - Truss, Removable Sign Panel Frames - 110" and 120" Sign Panels
S48	Overhead Signs - Lightweight Post Details
S49	Overhead Signs - Lightweight Foundation Details
S81	Overhead Laminated Sign - Single or Multiple Panel, Type A (1" Thick)
S82	Roadside Laminated Sign - Single or Multiple Panel, Type B (1" Thick)
S86	Laminated Panel Details - Extrusions for Type A, B and H Panels
S87	Type A-1 Mounting Hardware - Overhead Laminated Type A Panel, Truss and Lightweight Sign Structures
S89	Roadside Sign - Formed Single Sheet Aluminum Panel
S90	Channel and Bolt Hole Location, Overhead Formed Sign Panel
S91	Overhead Sign - Formed Sign Panel, Type A-3 Mounting Hardware
S92	Overhead Sign - Formed Sign Panel
S93	Framing Details for Framed Single Sheet Aluminum Signs, Rectangular Shape
S94	Roadside Framed Single Sheet Aluminum Signs, Rectangular Shape
S95	Roadside Single Sheet Aluminum Signs, Diamond Shape
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-2A	Electrical Systems (Service Equipment)
RSP ES-2C	Electrical Systems (Service Equipment Enclosure Notes, Type III Series)
RSP ES-2E	Electrical Systems (Service Equipment Enclosure and Typical Wiring Diagram, Type III - B Series)
RSP ES-2F	Electrical Systems (Service Equipment Enclosure and Typical Wiring Diagram Type III - C Series)
RSP ES-3A	Electrical Systems (Controller Cabinet Details)
RSP ES-3B	Electrical Systems (Controller Cabinet Adapter, Foundations, and Pad Details)
RSP ES-3C	Electrical Systems (Controller Cabinet Foundation and Pad Details)
RSP ES-3H	Electrical Systems (Irrigation Controller Enclosure Cabinet)
RSP ES-3I	Electrical Systems (BBS Power Connection Diagram, with Bypass Control Line)
RSP ES-4A	Electrical Systems (Signal Heads and Mountings)
RSP ES-4B	Electrical Systems (Pedestrian Signal Heads)
RSP ES-4C	Electrical Systems (Signal Heads and Mountings)
RSP ES-4D	Electrical Systems (Signal Head Mounting)
RSP ES-4E	Electrical Systems (Signal Heads and Optical Detector Mounting)
RSP ES-5A	Electrical Systems (Loop Detectors)
RSP ES-5B	Electrical Systems (Detectors)
RSP ES-5C	Electrical Systems (Accessible Pedestrian Signal and Push Button Assemblies)

RSP ES-5D	Electrical Systems (Curb and Shoulder Termination, Trench, and Handhole Details)
RSP ES-6A	Electrical Systems (Lighting Standard, Types 15 and 21)
ES-6B	Electrical Systems (Electrolier Anchorage and Grouting for Types 15 and 21, Barrier Rail Mounted)
RSP ES-6E	Electrical Systems (Lighting Standard, Types 30 and 31)
RSP ES-6F	Electrical Systems (Lighting Standard, Slip Base Plate)
RSP ES-7A	Electrical Systems (Signal and Lighting Standard, Type TS, and Push Button Assembly Post)
RSP ES-7B	Electrical Systems (Signal and Lighting Standard, Type 1 and Equipment Identification Characters)
RSP ES-7E	Electrical Systems (Signal and Lighting Standard, Case 3 Signal Mast Arm Loading, Wind Velocity = 100 mph and Signal Mast Arm Lengths 15' to 45')
RSP ES-7F	Electrical Systems (Signal and Lighting Standard, Case 4 Signal Mast Arm Loading, Wind Velocity = 100 mph and Signal Mast Arm Lengths 25' to 45')
RSP ES-7G	Electrical Systems (Signal And Lighting Standard, Case 5 Signal Mast Arm Loading, Wind Velocity = 100 mph and Signal Mast Arm Lengths 50' to 55')
RSP ES-7H	Electrical Systems (Signal and Lighting Standard, Case 5 Signal Mast Arm Loading, Wind Velocity = 100 mph and Signal Mast Arm Lengths 60' to 65')
RSP ES-7J	Electrical Systems (Flashing Beacon on a Type 1, Type 15-FBS, and Type 40 Standard)
RSP ES-7M	Electrical Systems (Signal and Lighting Standard, Detail No. 1)
RSP ES-7N	Electrical Systems (Signal and Lighting Standard, Detail No. 2)
ES-7O	Electrical Systems (Signal and Lighting Standard, Detail No. 3)
ES-7P	Electrical Systems (Internally Illuminated Street Name Sign)
RSP ES-7R	Electrical Systems (Signal and Lighting, Miscellaneous Attachment)
RSP ES-8A	Electrical Systems (Non-Traffic Pull Box)
RSP ES-8B	Electrical Systems (Traffic Pull Box)
RSP ES-9A	Electrical Systems (Structure Pull Box Installations)
RSP ES-9B	Electrical Systems (Conduit Riser and Expansion Fitting, Structure Installations)
RSP ES-9C	Electrical Systems (Structure Pull Box)
RSP ES-9D	Electrical Systems (Structure Pull Box Installations)
RSP ES-9E	Electrical Systems (Flush-Mounted Soffit, Pendant Soffit and Wall-Mounted Luminaire, Structure Installations)
RSP ES-9F	Electrical Systems (Flush-Mounted Soffit Luminaire Details)
RSP ES-10A	Electrical Systems (Isofootcandle Curves)
RSP ES-10B	Electrical Systems (Isofootcandle Curves)
RSP ES-11	Electrical Systems (Foundation Installations)
RSP ES-13A	Electrical Systems (Splicing Details)
ES-13B	Electrical Systems (Fuse Rating, Kinking and Banding Detail)
ES-14B	Electrical Systems (Control Assembly Wiring Diagrams)
ES-15A	Electrical Systems (Sign Illumination Equipment)
RSP ES-15C	Electrical Systems (Sign Illumination Equipment)

RSP ES-15D Electrical Systems (Lighting and Sign Illumination Control)

RSP ES-16A Electrical Systems (Closed Circuit Television, 5' to 15' Overhead Sign Mounted 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
A40A	01-15-16	A77J3	07-19-13	S135	07-19-13
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		



# NOTICE TO BIDDERS

Bids open Wednesday, April 27, 2016

Dated March 7, 2016

General work description: Construct HOV lanes and mix flow lanes.

The Department will receive sealed bids for CONSTRUCTION ON STATE HIGHWAY IN LOS ANGELES AND ORANGE COUNTIES IN BUENA PARK, LA MIRADA, CERRITOS AND SANTA FE SPRINGS FROM ARTESIA BOULEVARD UNDERCROSSING TO NORTH FORK COYOTE CREEK.

District-County-Route-Post Mile: 07-LA,Ora-5-0.0/1.5, 44.3/44.4

Contract No. 07-2159U4

The Contractor must have either a Class A license or any combination of the following Class C licenses which constitutes a majority of the work: C-8, C-12.

The DBE Contract goal is 13 percent.

Federal-aid project no.:

ACNHPI-005-2(981)N  
DEMO06-6207(062)N

For the Federal training program, the number of trainees or apprentices is 54.

Bids must be on a unit price basis.

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

Complete the work, including plant establishment work, within 1,150 working days.

Complete the plant establishment work within 250 working days.

The estimated cost of the project is \$150,000,000.

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](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](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

D07AK/MP/SM

**BID ITEM LIST**

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
1	070030	LEAD COMPLIANCE PLAN	LS	LUMP SUM
2	080050	PROGRESS SCHEDULE (CRITICAL PATH METHOD)	LS	LUMP SUM
3	090100	TIME-RELATED OVERHEAD (WDAY)	WDAY	900
4	120090	CONSTRUCTION AREA SIGNS	LS	LUMP SUM
5	120100	TRAFFIC CONTROL SYSTEM	LS	LUMP SUM
6	120120	TYPE III BARRICADE	EA	310
7	120165	CHANNELIZER (SURFACE MOUNTED)	EA	800
8	121161	TEMPORARY TERMINAL SECTION (TYPE K)	EA	1
9	128605	TEMPORARY SIGNAL AND LIGHTING	LS	LUMP SUM
10	129000	TEMPORARY RAILING (TYPE K)	LF	87,800
11	129100	TEMPORARY CRASH CUSHION MODULE	EA	460
12	130100	JOB SITE MANAGEMENT	LS	LUMP SUM
13	130300	PREPARE STORM WATER POLLUTION PREVENTION PLAN	LS	LUMP SUM
14	130310	RAIN EVENT ACTION PLAN	EA	83
15	130320	STORM WATER SAMPLING AND ANALYSIS DAY	EA	47
16	130330	STORM WATER ANNUAL REPORT	EA	4
17	130500	TEMPORARY EROSION CONTROL BLANKET	SQYD	61,100
18	029576	IMPERMEABLE MEMBRANE	SQYD	6,050
19	130505	MOVE-IN/MOVE-OUT (TEMPORARY EROSION CONTROL)	EA	18
20	130510	TEMPORARY MULCH	SQYD	3,400

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
21	130520	TEMPORARY HYDRAULIC MULCH	SQYD	3,000
22	130560	TEMPORARY SOIL BINDER	SQYD	3,000
23	130570	TEMPORARY COVER	SQYD	3,000
24	130620	TEMPORARY DRAINAGE INLET PROTECTION	EA	80
25	130640	TEMPORARY FIBER ROLL	LF	17,600
26	130650	TEMPORARY GRAVEL BAG BERM	LF	43,400
27	130680	TEMPORARY SILT FENCE	LF	2,000
28	130710	TEMPORARY CONSTRUCTION ENTRANCE	EA	10
29	130730	STREET SWEEPING	LS	LUMP SUM
30	130900	TEMPORARY CONCRETE WASHOUT	LS	LUMP SUM
31	141101	REMOVE YELLOW PAINTED TRAFFIC STRIPE (HAZARDOUS WASTE)	LF	32,400
32	141103	REMOVE YELLOW THERMOPLASTIC TRAFFIC STRIPE (HAZARDOUS WASTE)	LF	11,700
33	141110	WORK AREA MONITORING (BRIDGE)	LS	LUMP SUM
34	141120	TREATED WOOD WASTE	LB	125,000
35	029577	HAZARDOUS MATERIALS MITIGATION PLANS	LS	LUMP SUM
36	029578	CONTAMINATED MATERIALS	CY	23,500
37	029579	CONTAMINATED LIQUIDS	GAL	348,000
38	148005	NOISE MONITORING	LS	LUMP SUM
39	150305	OBLITERATE SURFACING	SQYD	45,700
40	150608	REMOVE CHAIN LINK FENCE	LF	9,880

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
41	150620	REMOVE GATE	EA	2
42	150661	REMOVE GUARDRAIL	LF	1,940
43	150667	REMOVE DOUBLE METAL BEAM BARRIER	LF	5,350
44	150685	REMOVE IRRIGATION FACILITY	LS	LUMP SUM
45	150711	REMOVE PAINTED TRAFFIC STRIPE	LF	83,700
46	150712	REMOVE PAINTED PAVEMENT MARKING	SQFT	130
47	150714	REMOVE THERMOPLASTIC TRAFFIC STRIPE	LF	43,700
48	150715	REMOVE THERMOPLASTIC PAVEMENT MARKING	SQFT	180
49	150722	REMOVE PAVEMENT MARKER	EA	11,600
50	150742	REMOVE ROADSIDE SIGN	EA	150
51	150757	REMOVE SIGN STRUCTURE (EA)	EA	6
52	150812	REMOVE PIPE (LF)	LF	13,800
53	150820	REMOVE INLET	EA	65
54	150826	REMOVE MANHOLE	EA	10
55	150827	REMOVE CATCH BASIN	EA	21
56	150832	REMOVE RETAINING WALL (CY)	CY	325
57	150854	REMOVE CONCRETE PAVEMENT (CY)	CY	12,600
58	150857	REMOVE ASPHALT CONCRETE SURFACING	SQFT	25,000
59	152390	RELOCATE ROADSIDE SIGN	EA	13
60	152432	ADJUST MANHOLE	EA	1

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
61	152440	ADJUST MANHOLE TO GRADE	EA	10
62	153121	REMOVE CONCRETE (CY)	CY	920
63	153140	REMOVE CONCRETE SIDEWALK (SQYD)	SQYD	4,910
64	153211	REMOVE CONCRETE SIDEWALK AND DRIVEWAY	CY	370
65	153215	REMOVE CONCRETE (CURB AND GUTTER)	LF	34,200
66	153221	REMOVE CONCRETE BARRIER	LF	2,910
67	153229	REMOVE CONCRETE BARRIER (TYPE K)	LF	2,200
68	153248	REMOVE CONCRETE (MISCELLANEOUS) (SQFT)	SQFT	5,990
69	029580	REMOVE CONCRETE MASONRY BLOCK WALL	SQFT	200
70	156572	REMOVE RAILING	LS	LUMP SUM
71	157551	BRIDGE REMOVAL, LOCATION A	LS	LUMP SUM
72	157552	BRIDGE REMOVAL, LOCATION B	LS	LUMP SUM
73	157561	BRIDGE REMOVAL (PORTION), LOCATION A	LS	LUMP SUM
74	157562	BRIDGE REMOVAL (PORTION), LOCATION B	LS	LUMP SUM
75	157563	BRIDGE REMOVAL (PORTION), LOCATION C	LS	LUMP SUM
76	160102	CLEARING AND GRUBBING (LS)	LS	LUMP SUM
77	190101	ROADWAY EXCAVATION	CY	317,000
78	190107	ROADWAY EXCAVATION (TYPE Y-1) (AERIALY DEPOSITED LEAD)	CY	3,380
79	190108	ROADWAY EXCAVATION (TYPE Y-2) (AERIALY DEPOSITED LEAD)	CY	3,430
80 (F)	192001	STRUCTURE EXCAVATION	CY	2,402

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
81 (F)	192003	STRUCTURE EXCAVATION (BRIDGE)	CY	20,019
82	045031	STRUCTURE EXCAVATION (CONTAMINATED MATERIALS)	CY	4,397
83 (F)	192020	STRUCTURE EXCAVATION (TYPE D)	CY	3,971
84 (F)	192037	STRUCTURE EXCAVATION (RETAINING WALL)	CY	35,990
85	192057	STRUCTURE EXCAVATION (TYPE Y-1) (AERIALY DEPOSITED LEAD)	CY	49
86	192058	STRUCTURE EXCAVATION (TYPE Y-2) (AERIALY DEPOSITED LEAD)	CY	33
87 (F)	193001	STRUCTURE BACKFILL	CY	372
88 (F)	193003	STRUCTURE BACKFILL (BRIDGE)	CY	10,608
89 (F)	193013	STRUCTURE BACKFILL (RETAINING WALL)	CY	29,101
90 (F)	193031	PERVIOUS BACKFILL MATERIAL (RETAINING WALL)	CY	8
91	194001	DITCH EXCAVATION	CY	180
92	198010	IMPORTED BORROW (CY)	CY	111,000
93	045032	GEOSYNTHETIC REINFORCED ENBANKMENT	CY	1,060
94	200002	ROADSIDE CLEARING	LS	LUMP SUM
95	200114	ROCK BLANKET	SQFT	134,000
96	202006	SOIL AMENDMENT	CY	110
97	202039	SLOW-RELEASE FERTILIZER	LB	2,090
98	204008	PLANT (GROUP H)	EA	41,200
99	204009	PLANT (GROUP I)	EA	22,200
100	204035	PLANT (GROUP A)	EA	200

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
101	204038	PLANT (GROUP U)	EA	65
102	204099	PLANT ESTABLISHMENT WORK	LS	LUMP SUM
103	205035	WOOD MULCH	CY	250
104	206400	CHECK AND TEST EXISTING IRRIGATION FACILITIES	LS	LUMP SUM
105	206402	OPERATE EXISTING IRRIGATION FACILITIES	LS	LUMP SUM
106	206560	CONTROL AND NEUTRAL CONDUCTORS	LS	LUMP SUM
107	206562	1" REMOTE CONTROL VALVE	EA	21
108	206564	1 1/2" REMOTE CONTROL VALVE	EA	9
109	206565	2" REMOTE CONTROL VALVE	EA	2
110	206749	8 STATION IRRIGATION CONTROLLER (WALL MOUNTED)	EA	1
111	206757	16-18 STATION IRRIGATION CONTROLLER (WALL MOUNTED)	EA	2
112	208003	1" GALVANIZED STEEL PIPE (SUPPLY LINE)	LF	20
113	208006	2" GALVANIZED STEEL PIPE (SUPPLY LINE)	LF	40
114	208301	IRRIGATION CONTROLLER ENCLOSURE CABINET	EA	3
115	208423	1" BACKFLOW PREVENTER ASSEMBLY	EA	1
116	208426	2" BACKFLOW PREVENTER ASSEMBLY	EA	2
117	208442	FLOW SENSOR	EA	3
118	208446	RISER SPRINKLER ASSEMBLY (GEAR DRIVEN)	EA	120
119	208448	RISER SPRINKLER ASSEMBLY	EA	220
120	208449	POP-UP SPRINKLER ASSEMBLY	EA	220

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
121	208575	2" GATE VALVE	EA	3
122	208590	6" GATE VALVE	EA	1
123 (F)	208594	3/4" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE)	LF	7,025
124 (F)	208595	1" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE)	LF	2,640
125 (F)	208596	1 1/4" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE)	LF	2,690
126 (F)	208597	1 1/2" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE)	LF	4,138
127 (F)	208598	2" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE)	LF	2,604
128 (F)	208602	6" PLASTIC PIPE (SCHEDULE 40) (SUPPLY LINE)	LF	1,195
129	208683	BALL VALVE	EA	8
130	208818	6" WELDED STEEL PIPE CONDUIT	LF	120
131	260303	CLASS 3 AGGREGATE BASE (CY)	CY	86,500
132	280000	LEAN CONCRETE BASE	CY	26,100
133	280015	LEAN CONCRETE BASE RAPID SETTING	CY	140
134	390132	HOT MIX ASPHALT (TYPE A)	TON	66,400
135	394060	DATA CORE	LS	LUMP SUM
136	029581	PLACE HOT MIX ASPHALT DIKE	LF	6,130
137	394090	PLACE HOT MIX ASPHALT (MISCELLANEOUS AREA)	SQYD	14,200
138	397005	TACK COAT	TON	48
139	401050	JOINTED PLAIN CONCRETE PAVEMENT	CY	54,400
140	401055	JOINTED PLAIN CONCRETE PAVEMENT (RSC)	CY	380

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
141	414242	ISOLATION JOINT SEAL (PREFORMED COMPRESSION)	LF	5,910
142	490550	FURNISH 24" STEEL PIPE PILING	LF	93,841
143	490555	DRIVE 24" STEEL PIPE PILE	EA	1,807
144	490606	42" CAST-IN-DRILLED-HOLE CONCRETE PILING	LF	5,913
145	490742	FURNISH PILING (CLASS 90) (ALTERNATIVE W)	LF	34,314
146	490743	DRIVE PILE (CLASS 90) (ALTERNATIVE W)	EA	669
147	490746	FURNISH PILING (CLASS 140) (ALTERNATIVE W)	LF	28,001
148	490747	DRIVE PILE (CLASS 140) (ALTERNATIVE W)	EA	476
149	495115	FURNISH 24" CAST-IN-STEEL SHELL CONCRETE PILING	LF	9,387
150	495116	DRIVE 24" CAST-IN-STEEL SHELL CONCRETE PILE	EA	242
151	498044	36" CAST-IN-DRILLED-HOLE CONCRETE PILE (SIGN FOUNDATION)	LF	15
152	498052	60" CAST-IN-DRILLED-HOLE CONCRETE PILE (SIGN FOUNDATION)	LF	240
153	500001	PRESTRESSING CAST-IN-PLACE CONCRETE	LS	LUMP SUM
154 (F)	510050	STRUCTURAL CONCRETE	CY	509
155 (F)	510051	STRUCTURAL CONCRETE, BRIDGE FOOTING	CY	6,964
156 (F)	510053	STRUCTURAL CONCRETE, BRIDGE	CY	32,419
157 (F)	510060	STRUCTURAL CONCRETE, RETAINING WALL	CY	8,787
158 (F)	510086	STRUCTURAL CONCRETE, APPROACH SLAB (TYPE N)	CY	884
159 (F)	510088	STRUCTURAL CONCRETE, APPROACH SLAB (TYPE N MODIFIED)	CY	420
160 (F)	510502	MINOR CONCRETE (MINOR STRUCTURE)	CY	740

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
161 (F)	045033	ARCHITECTURAL TREATMENT (SPLIT SLATE)	SQFT	50,108
162 (F)	045034	ARCHITECTURAL TREATMENT (WALL 8 MOTIF)	SQFT	930
163 (F)	045035	ARCHITECTURAL TREATMENT (SUNRAY-SPLIT SLATE)	SQFT	5,100
164 (F)	045036	ARCHITECTURAL TREATMENT (WALL 2 MOTIF)	SQFT	10,525
165 (F)	511064	FRACTURED RIB TEXTURE	SQFT	2,600
166	511106	DRILL AND BOND DOWEL	LF	2,366
167	511110	DRILL AND BOND DOWEL (CHEMICAL ADHESIVE)	EA	1,398
168	512281	FURNISH PRECAST PRESTRESSED CONCRETE BULB-TEE GIRDER (120'-130')	EA	14
169	512350	FURNISH PRECAST PRESTRESSED CONCRETE SLAB	SQFT	4,703
170	045037	FURNISH PRECAST PRESTRESSED CONCRETE SLAB (TYPE SIII MODIFIED)	SQFT	22,400
171 (F)	512500	ERECT PRECAST PRESTRESSED CONCRETE GIRDER	EA	14
172 (F)	512510	ERECT PRECAST PRESTRESSED CONCRETE DECK UNIT	EA	198
173 (F)	513501	CONCRETE CLOSURE WALL	SQFT	8,033
174	518051	PTFE SPHERICAL BEARING	EA	98
175	519081	JOINT SEAL (MR 1/2")	LF	751
176	519088	JOINT SEAL (MR 1")	LF	178
177	519091	JOINT SEAL (MR 1 1/2")	LF	135
178	519093	JOINT SEAL ASSEMBLY (MR 3")	LF	237
179	519094	JOINT SEAL ASSEMBLY (MR 3 1/2")	LF	135
180	519099	JOINT SEAL ASSEMBLY (MR 6")	LF	122

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
181	519100	JOINT SEAL (MR 2")	LF	143
182	519102	JOINT SEAL (TYPE AL)	LF	73
183	519109	JOINT SEAL ASSEMBLY (MR 6 1/2")	LF	148
184	519118	JOINT SEAL ASSEMBLY (MR 9")	LF	135
185 (F)	520101	BAR REINFORCING STEEL	LB	120,587
186 (F)	520102	BAR REINFORCING STEEL (BRIDGE)	LB	11,433,950
187 (F)	520103	BAR REINFORCING STEEL (RETAINING WALL)	LB	1,618,868
188 (F)	520110	BAR REINFORCING STEEL (EPOXY COATED) (BRIDGE)	LB	45,920
189 (F)	520115	BAR REINFORCING STEEL (GALVANIZED)	LB	6,837
190 (F)	520120	HEADED BAR REINFORCEMENT	EA	4,766
191 (F)	560213	FURNISH SIGN STRUCTURE (LIGHTWEIGHT)	LB	26,400
192 (F)	560214	INSTALL SIGN STRUCTURE (LIGHTWEIGHT)	LB	26,400
193 (F)	560218	FURNISH SIGN STRUCTURE (TRUSS)	LB	206,000
194 (F)	560219	INSTALL SIGN STRUCTURE (TRUSS)	LB	206,000
195	560233	FURNISH FORMED PANEL SIGN (OVERHEAD)	SQFT	2,400
196	560244	FURNISH LAMINATED PANEL SIGN (1"-TYPE A)	SQFT	820
197	560245	FURNISH LAMINATED PANEL SIGN (1"-TYPE B)	SQFT	96
198	560248	FURNISH SINGLE SHEET ALUMINUM SIGN (0.063"-UNFRAMED)	SQFT	990
199	560249	FURNISH SINGLE SHEET ALUMINUM SIGN (0.080"-UNFRAMED)	SQFT	580
200	560251	FURNISH SINGLE SHEET ALUMINUM SIGN (0.063"-FRAMED)	SQFT	44

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
201	560252	FURNISH SINGLE SHEET ALUMINUM SIGN (0.080"-FRAMED)	SQFT	310
202	562001	METAL (ROADSIDE SIGN)	LB	7,900
203	029582	METAL (MEDIAN BARRIER MOUNTED SIGN)	LB	1,130
204	562004	METAL (RAIL MOUNTED SIGN)	LB	1,020
205	566011	ROADSIDE SIGN - ONE POST	EA	35
206	566012	ROADSIDE SIGN - TWO POST	EA	10
207	568001	INSTALL SIGN (STRAP AND SADDLE BRACKET METHOD)	EA	16
208 (F)	620800	CONCRETE BACKFILL (PIPE TRENCH)	CY	340
209	029583	REINFORCED CONCRETE PIPE (12"-30")	LF	23,310
210	650026	36" REINFORCED CONCRETE PIPE	LF	1,170
211	650030	42" REINFORCED CONCRETE PIPE	LF	1,670
212	650034	48" REINFORCED CONCRETE PIPE	LF	300
213	650038	54" REINFORCED CONCRETE PIPE	LF	230
214	650042	60" REINFORCED CONCRETE PIPE	LF	240
215	029584	63" REINFORCED CONCRETE PIPE	LF	720
216	029585	69" REINFORCED CONCRETE PIPE	LF	620
217	029586	81" REINFORCED CONCRETE PIPE	LF	580
218	665717	18" SLOTTED CORRUGATED STEEL PIPE (.079" THICK)	LF	2,590
219	680902	6" PERFORATED PLASTIC PIPE UNDERDRAIN	LF	850
220	680903	6" NON-PERFORATED PLASTIC PIPE UNDERDRAIN	LF	600

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
221	681107	3" PLASTIC PIPE (EDGE DRAIN OUTLET)	LF	640
222 (F)	029587	CLASS 4 PERMEABLE MATERIAL	CY	280
223 (F)	029588	CLASS 5 PERMEABLE MATERIAL	CY	270
224	703233	GRATED LINE DRAIN	LF	42
225	029589	48" WELDED STEEL PIPE CASING (0.75" THICK)	LF	190
226	705206	24" CONCRETE FLARED END SECTION	EA	2
227	705529	42" AUTOMATIC DRAINAGE GATE	EA	1
228	707217	36" PRECAST CONCRETE PIPE MANHOLE	LF	180
229 (F)	721028	ROCK SLOPE PROTECTION (NO. 2, METHOD B) (CY)	CY	2
230	721420	CONCRETE (DITCH LINING)	CY	210
231	721430	CONCRETE (CHANNEL LINING)	CY	1
232 (F)	721612	CONCRETED-ROCK SLOPE PROTECTION (FACING, METHOD B) (CY)	CY	6
233	721810	SLOPE PAVING (CONCRETE)	CY	24
234 (F)	722020	GABION	CY	43
235	729011	ROCK SLOPE PROTECTION FABRIC (CLASS 8)	SQYD	28
236	730020	MINOR CONCRETE (CURB) (CY)	CY	130
237	731502	MINOR CONCRETE (MISCELLANEOUS CONSTRUCTION)	CY	49
238	731504	MINOR CONCRETE (CURB AND GUTTER)	CY	1,570
239	731507	MINOR CONCRETE (GUTTER DEPRESSION)	CY	3
240	731516	MINOR CONCRETE (DRIVEWAY)	CY	280

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
241	029590	MINOR CONCRETE (SIDEWALK AND CURB RAMP)	CY	1,830
242 (F)	750001	MISCELLANEOUS IRON AND STEEL	LB	113,272
243 (F)	750496	MISCELLANEOUS METAL (RESTRAINER - PIPE TYPE)	LB	16,229
244 (F)	750500	MISCELLANEOUS METAL	LB	230
245 (F)	750501	MISCELLANEOUS METAL (BRIDGE)	LB	626
246 (F)	750505	BRIDGE DECK DRAINAGE SYSTEM	LB	96,240
247	029591	8" VITRIFIED CLAY SEWER PIPE	LF	710
248	029592	10" VITRIFIED CLAY SEWER PIPE	LF	3,160
249	029593	VITRIFIED CLAY SEWER PIPE (15"-24")	LF	840
250	029594	18" DUCTILE IRON PIPE	LF	170
251	029595	SEWER MANHOLE FRAME AND COVER	EA	21
252	029596	CONCRETE SEWER MANHOLE	EA	21
253	029597	ABANDON SEWER PIPE	LF	4,060
254	029598	ABANDON SEWER MANHOLE	EA	15
255	770070	REMOVE SEWER MANHOLE	EA	5
256	770075	REMOVE SEWER PIPE	LF	1,020
257	029599	FURNISH AND INSTALL 8" CEMENT LINED DUCTILE IRON PIPE (CL 52) (DOUBLE CEMENT LINED)	LF	310
258	029600	FURNISH AND INSTALL 12" CEMENT LINED DUCTILE IRON PIPE (CL 52) (DOUBLE CEMENT LINED)	LF	2,920
259	029601	FURNISH AND INSTALL PIPELINE CONNECTIONS	EA	4
260	029602	FURNISH AND INSTALL 16" STEEL CASING	LF	20

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
261	029603	FURNISH AND INSTALL 24" STEEL CASING	LF	480
262	029604	FURNISH AND INSTALL 12" GATE VALVE AND BOX ASSEMBLY	EA	6
263	029605	FURNISH AND INSTALL FIRE HYDRANT ASSEMBLY	EA	10
264	029606	FURNISH AND INSTALL AIR VACUUM AND AIR RELEASE VALVE ASSEMBLY	EA	6
265	029607	FURNISH AND INSTALL BLOWOFF VALVE ASSEMBLY	EA	3
266	029608	FURNISH AND INSTALL COPPER SERVICE ASSEMBLY	EA	7
267	029609	FURNISH AND INSTALL CONCRETE ENCASEMENT	LF	22
268	029610	FURNISH AND INSTALL BACKFLOW PREVENTER ASSEMBLY (DOUBLE CHECK TYPE)	EA	2
269	029611	TRENCHLESS CULVERT	LF	120
270	800103	TEMPORARY FENCE (TYPE CL-6)	LF	19,000
271	800361	CHAIN LINK FENCE (TYPE CL-6, VINYL-CLAD)	LF	1,650
272	029612	7' CHAIN LINK GATE (TYPE CL-6)	EA	8
273	820110	MILEPOST MARKER	EA	16
274	832007	MIDWEST GUARDRAIL SYSTEM (WOOD POST)	LF	2,350
275	832070	VEGETATION CONTROL (MINOR CONCRETE)	SQYD	400
276 (F)	045038	CHAIN LINK RAILING (MODIFIED)	LF	2,458
277 (F)	833022	3' CHAIN LINK RAILING (TYPE 6 MOD)	LF	8,617
278	833077	PEDESTRIAN BARRICADE	EA	2
279 (F)	833090	TUBULAR HANDRAILING (MODIFIED)	LF	6,055
280 (F)	833142	CONCRETE BARRIER (TYPE 26 MODIFIED)	LF	8,507

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
281 (F)	839521	CABLE RAILING	LF	425
282	839543	TRANSITION RAILING (TYPE WB-31)	EA	2
283	839576	END CAP (TYPE A)	EA	5
284	839578	END CAP (TYPE TC)	EA	2
285	839581	END ANCHOR ASSEMBLY (TYPE SFT)	EA	5
286	839585	ALTERNATIVE FLARED TERMINAL SYSTEM	EA	5
287	029614	ALTERNATIVE CRASH CUSHION	EA	3
288	029615	CONCRETE BARRIER (TYPE 60C MOD)	LF	260
289 (F)	839702	CONCRETE BARRIER (TYPE 60A)	LF	108
290	839707	CONCRETE BARRIER (TYPE 60GA)	LF	202
291	839709	CONCRETE BARRIER (TYPE 60GE)	LF	1,140
292	029616	CONCRETE BARRIER (TYPE 60C,D,S,G)	LF	9,300
293 (F)	839726	CONCRETE BARRIER (TYPE 736A)	LF	1,917
294 (F)	839727	CONCRETE BARRIER (TYPE 736 MODIFIED)	LF	2,554
295 (F)	045039	CONCRETE BARRIER (TYPE 736A MODIFIED)	LF	3,117
296 (F)	045040	CONCRETE BARRIER (TYPE 736A MODIFIED B)	LF	20
297 (F)	839742	CONCRETE BARRIER (TYPE 736B MOD)	LF	9,677
298	840504	4" THERMOPLASTIC TRAFFIC STRIPE	LF	74,100
299	840506	8" THERMOPLASTIC TRAFFIC STRIPE	LF	69,200
300	840508	8" THERMOPLASTIC TRAFFIC STRIPE (BROKEN 12-3)	LF	7,500

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
301	840515	THERMOPLASTIC PAVEMENT MARKING	SQFT	9,980
302	840521	4" THERMOPLASTIC TRAFFIC STRIPE (BROKEN 6-1)	LF	1,220
303	840525	4" THERMOPLASTIC TRAFFIC STRIPE (BROKEN 36-12)	LF	68,200
304	840526	4" THERMOPLASTIC TRAFFIC STRIPE (BROKEN 17-7)	LF	12,900
305	840550	8" THERMOPLASTIC TRAFFIC STRIPE (BROKEN 36-12)	LF	4,160
306	840656	PAINT TRAFFIC STRIPE (2-COAT)	LF	310,000
307	840666	PAINT PAVEMENT MARKING (2-COAT)	SQFT	1,700
308	850101	PAVEMENT MARKER (NON-REFLECTIVE)	EA	15,500
309	850111	PAVEMENT MARKER (RETROREFLECTIVE)	EA	12,200
310	860090	MAINTAINING EXISTING TRAFFIC MANAGEMENT SYSTEM ELEMENTS DURING CONSTRUCTION	LS	LUMP SUM
311	860201	SIGNAL AND LIGHTING	LS	LUMP SUM
312	860297	SIGNAL AND LIGHTING (CITY)	LS	LUMP SUM
313	860400	LIGHTING (TEMPORARY)	LS	LUMP SUM
314	860402	LIGHTING (CITY STREET)	LS	LUMP SUM
315	029618	LIGHTING (UNION PACIFIC RAILROAD)	LS	LUMP SUM
316	029619	LIGHTING (TEMPORARY) CITY	LS	LUMP SUM
317	860705	INTERCONNECTION CONDUIT AND CABLE (LS)	LS	LUMP SUM
318	860797	ELECTRIC SERVICE (IRRIGATION)	LS	LUMP SUM
319	030835	SPRINKLER CONTROL CONDUIT (BRIDGE) (LS)	LS	LUMP SUM
320	860889	MODIFY TRAFFIC MONITORING STATION	LS	LUMP SUM

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
321	029620	TEMPORARY TRAFFIC MONITORING STATION (LOCATION 1)	LS	LUMP SUM
322	860930	TRAFFIC MONITORING STATION	LS	LUMP SUM
323	029621	MODIFY COMMUNICATION SYSTEM	LS	LUMP SUM
324	029622	TEMPORARY WIRELESS CLOSED CIRCUIT TELEVISION SYSTEM	LS	LUMP SUM
325	029623	WORK AT NORWALK HUB AND LOS ANGELES REGIONAL TRAFFIC MANAGEMENT CENTER	LS	LUMP SUM
326	029624	WORK AT LOS ANGELES REGIONAL TRANSPORTATION MANAGEMENT CENTER	LS	LUMP SUM
327	861088	MODIFY RAMP METERING SYSTEM	LS	LUMP SUM
328	029625	TEMPORARY RAMP METERING SYSTEM	LS	LUMP SUM
329	861100	RAMP METERING SYSTEM	LS	LUMP SUM
330	029626	MODIFY SIGNAL AND LIGHTING (CITY)	LS	LUMP SUM
331	861504	MODIFY LIGHTING AND SIGN ILLUMINATION	LS	LUMP SUM
332	030829	SYSTEM TESTING AND DOCUMENTATION	LS	LUMP SUM
333	029627	CLASS D FILTER FABRIC	SQYD	940
334	995100	WATER METER CHARGES	LS	LUMP SUM
335	999990	MOBILIZATION	LS	LUMP SUM

# SPECIAL PROVISIONS

## ORGANIZATION

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

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

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

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## DIVISION I GENERAL PROVISIONS

### 1 GENERAL

**Add to section 1-1.01:**

#### Bid Items and Applicable Sections

Item code	Item description	Applicable section
029576	IMPERMEABLE MEMBRANE	13
029577	HAZARDOUS MATERIALS MITIGATION PLANS	13
029578	CONTAMINATED MATERIALS	14
029579	CONTAMINATED LIQUIDS	14
029580	REMOVE CONCRETE MASONRY BLOCK WALL	15
045031	STRUCTURE EXCAVATION (CONTAMINATED MATERIAL)	19
045032	GEOSYNTHETIC REINFORCED ENBANKMENT	19
029581	PLACE HOT MIX ASPHALT DIKE	
045033	ARCHITECTURAL TREATMENT (SPLIT SLATE)	51
045034	ARCHITECTURAL TREATMENT (WALL 8 MOTIF)	51
045035	ARCHITECTURAL TREATMENT (SUNRAY-SPLIT SLATE)	51
045036	ARCHITECTURAL TREATMENT (WALL 2 MOTIF)	51
045037	FURNISH PRECAST PRESTRESSED CONCRETE SLAB (TYPE SIII MODIFIED)	51
029582	METAL (MEDIAN BARRIER MOUNTED SIGN)	56
029583	REINFORCED CONCRETE PIPE (12"-30")	
029584	63" REINFORCED CONCRETE PIPE	65
029585	69" REINFORCED CONCRETE PIPE	65
029586	81" REINFORCED CONCRETE PIPE	65
029587	CLASS 4 PERMEABLE MATERIAL	68
029588	CLASS 5 PERMEABLE MATERIAL	68
029589	48" WELDED STEEL PIPE CASING (0.75" THICK)	70
029590	MINOR CONCRETE (SIDEWALK AND CURB RAMP)	73
029591	8" VITRIFIED CLAY SEWER PIPE	77
029592	10" VITRIFIED CLAY SEWER PIPE	77
029593	VITRIFIED CLAY SEWER PIPE (15"-24")	77
029594	18" DUCTILE IRON PIPE	77
029595	SEWER MANHOLE FRAME AND COVER	77

029596	CONCRETE SEWER MANHOLE	77
029597	ABANDON SEWER PIPE	77
029598	ABANDON SEWER MANHOLE	77
029599	FURNISH AND INSTALL 8" CEMENT LINED DUCTILE IRON PIPE (CL 52) (DOUBLE CEMENT LINED)	77
029600	FURNISH AND INSTALL 12" CEMENT LINED DUCTILE IRON PIPE (CL 52) (DOUBLE CEMENT LINED)	77
029601	FURNISH AND INSTALL PIPELINE CONNECTIONS	77
029602	FURNISH AND INSTALL 16" STEEL CASING	77
029603	FURNISH AND INSTALL 24" STEEL CASING	77
029604	FURNISH AND INSTALL 12" GATE VALVE AND BOX ASSEMBLY	77
029605	FURNISH AND INSTALL FIRE HYDRANT ASSEMBLY	77
029606	FURNISH AND INSTALL AIR VACUUM AND AIR RELEASE VALVE ASSEMBLY	77
029607	FURNISH AND INSTALL BLOWOFF VALVE ASSEMBLY	77
029608	FURNISH AND INSTALL COPPER SERVICE ASSEMBLY	77
029609	FURNISH AND INSTALL CONCRETE ENCASEMENT	77
029610	FURNISH AND INSTALL BACKFLOW PREVENTER ASSEMBLY (DOUBLE CHECK TYPE)	77
029611	TRENCHLESS CULVERT	78
029612	7' CHAIN LINK GATE (TYPE CL-6)	80
045038	CHAIN LINK RAILING (MODIFIED)	83
029613	3' CHAIN LINK RAILING (TYPE 6 MOD)	83
029614	ALTERNATIVE CRASH CUSHION	83
029615	CONCRETE BARRIER (TYPE 60C MOD)	83
029616	CONCRETE BARRIER (TYPE 60C,D,S,G)	83
045039	CONCRETE BARRIER (TYPE 736A MODIFIED)	83
045040	CONCRETE BARRIER (TYPE 736A MODIFIED B)	83
029617	CONCRETE BARRIER (TYPE 736B MOD)	83
029618	LIGHTING (UNION PACIFIC RAILROAD)	86
029619	LIGHTING (TEMPORARY) CITY	86
030835	SPRINKLER CONTROL CONDUIT (BRIDGE) (LS)	86
029620	TEMPORARY TRAFFIC MONITORING STATION (LOCATION 1)	86
029621	MODIFY COMMUNICATION SYSTEM	86
029622	TEMPORARY WIRELESS CLOSED CIRCUIT TELEVISION SYSTEM	86
029623	WORK AT NORWALK HUB AND LOS ANGELES REGIONAL TRANSPORTATION MANAGEMENT CENTER	86
029624	WORK AT LOS ANGELES REGIONAL TRANSPORTATION MANAGEMENT CENTER	86
029625	TEMPORARY RAMP METERING SYSTEM	86
029626	MODIFY SIGNAL AND LIGHTING (CITY)	86
030829	SYSTEM TESTING AND DOCUMENTATION	86
029627	CLASS D FILTER FABRIC	88
995100	WATER METER CHARGES	5

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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 <i>Information Handout</i>	<ol style="list-style-type: none"> <li>1. US Army Corp of Engineers Section 408 and 404</li> <li>2. Los Angeles County Permit PCFL 201404500</li> <li>3. Los Angeles County Permit PCFL 201202742</li> <li>4. Los Angeles County Permit PCFL 201300613</li> <li>5. Los Angeles Regional Water Quality Board</li> <li>6. Orange County Encroachment Permit</li> <li>7. Railroad Relations</li> <li>8. Revised foundation report for Valley View OH/OC (replace), bridge no. 53-3045 dated 07/11/2013</li> <li>9. Revised foundation report for Valley View Avenue SB Off Ramp, bridge no. 53-3058K dated 07/11/2013</li> <li>10. Revised foundation report for Valley View Avenue SB On Ramp, bridge no. 53-3059K dated 07/11/2013</li> <li>11. Foundation report for NB Valley View Avenue/S Firestone Blvd, bridge no. 53C-2295 dated 08/29/2013</li> <li>12. Foundation report for SB Valley View Avenue /S Firestone Blvd, bridge no. 53C-2296 dated 07/02/2015</li> <li>13. Foundation report for N Firestone Blvd Bridge, bridge no. 53C-2194 dated 05/30/2013</li> <li>14. Foundation report for Coyote Creek Bridge (replace), bridge no. 53-3044 dated 05/30/2013</li> <li>15. Addendum foundation report – Coyote Creek, Br. No. 53-3044, dated 6/24/15</li> <li>16. Revised foundation report for Retaining Walls 52, 55, 68, 69, 70, 73, 80, VA85, SF3, SF4, DW87, DW88, VA87, VA88, VA103, VA104, VA107, VA108, VA109, DW108, NF65, DW109, NF66, dated 07/16/2013</li> <li>17. Foundation report for Retaining Walls RWFIR4 &amp; RWFIR5 dated 08/29/2013</li> <li>18. Revised foundation report for Retaining Walls RWFIR7 &amp; RWFIR8 dated 07/02/2015</li> <li>19. Revised foundation report for Retaining Walls 2, 8, NF 60, AC62, AC63, NF62 &amp; TR3 dated 06/20/2013,</li> <li>20. Final hydraulic report (Coyote Creek Bridge (replace), bridge no. 53-3044) dated 12/23/2011</li> <li>21. Foundation report (addendum) for Retaining Wall 2 and 8 dated 12/3/2013</li> <li>22. Supplemental report for 5 Valley View bridges, North Firestone &amp; Coyote Creek Bridges dated 1/6/2014</li> <li>23. Foundation report (addendum) for Valley View OH/OC (replace), bridge no. 53-3045, dated 3/17/2014.</li> <li>24. Aerially Deposited Lead Investigation Report</li> <li>25. Right-of-Way Information</li> <li>26. Geotechnical Design Report for Trenchless Culvert</li> <li>27. Cross Section</li> </ol>
Available as specified in the <i>Standard Specifications</i>	As-built drawing
Included with the project plans	Logs of test borings

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## 5 CONTROL OF WORK

### Add to section 5-1.09A:

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

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

To afford the project team enough time to plan and hold the session, a maximum of 20 days may be added to the DRB referral time following the Engineer's response to a *Supplemental Potential Claim Record*.

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

If the session is not held, the DRB referral time remains in effect as specified in section 5-1.43.

### Add to section 5-1.20A:

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

#### Coincident or Adjacent Contracts

Contract no.	County–Route–Post Mile	Location	Type of work
07-215944	LA-5-4.2/5.7	Norwalk	Freeway, ramps, local streets, bridges reconstruction and widening.
07-215934	LA-5 – 2.4/4.2	Norwalk and Santa Fe Springs	Freeway, ramps, local streets, bridges reconstruction and widening.
07-2159C4	LA-5- KP 2.9/4.9	Norwalk and Santa Fe Springs	Freeway, ramps, local streets, bridges reconstruction and widening.
07-215914	LA-5 – 1.2/2.1	Santa Fe Springs	Freeway, ramps, local streets, bridges reconstruction and widening.
07-215954	LA-5 - 0.0/7.6	La Mirada, Santa Fe, Norwalk and Downey	Freeway, ramps, local streets, bridges reconstruction and widening.

**Replace section 5-1.20D with:**

**5-1.20D Occupied Improvements within the Right-of-Way**

Occupied improvements are within the right-of-way at:

Parcel	Date available
Parcel 77047	09/10/2016
Parcel 77604	07/01/2016
Parcel 77605	05/20/2016
Parcel 77608	08/23/2015
Parcel 77609	04/20/2016
Parcel 77611	12/01/2015
Parcel 77791	12/21/2015
Parcel 77792	08/23/2015
Parcel 77793	08/23/2015
Parcel 77794	06/12/2016
Parcel 77796	03/07/2016
Parcel 77797	08/01/2015
Parcel 78982	08/23/2015
Parcel 79831	10/01/2015
Parcel 79843	04/24/2016
Parcel 79850	05/20/2016
Parcel 79856	04/11/2016
Parcel 79857	04/11/2016
Parcel 79869	06/25/2015
Parcel 79887	09/10/2016
Parcel 80338	06/29/2016

Do not take any action that will result in unnecessary inconvenience or disproportionate injury to or that is coercive in nature to the occupants of the improvements.

**Add to section 5-1.20E:**

The local water authority is Suburban water systems.

The charges are as shown in the following table

<b>Water Meter Charges</b>		
Meter size	Quantity	Charge per meter (\$)
1"	1	11,000
2"	2	17,000

**Add to section 5-1.36D:**

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

1. Verified by a representative of the utility company
2. Allowing at least the time shown for the utility owner to complete its work

**Utility Relocation and Contractor-Arranged Time for the Relocation**

Utility	Utility address	Location	Days
SWS 12" PVC, CL-350 pipe To be relocated	Suburban Water System 1325 N Grand Ave Suite 100 Covina, CA 91724-4044	City of La Mirada, North side of freeway on Firestone Blvd from Knott Ave STA 47+00 to 71+17 (U-15, U-16 and U-17)	30 days of Notice to Owner. 61 Working days of construction
SWS12" PVC, CL-350 pipe To be relocated	Suburban Water System 1325 N Grand Ave Suite 100 Covina, CA 91724-4044	North side of freeway along Valley View Ave. from STA "VAL" 114+00 to 104+00 (U-23)	30 days of Notice to Owner. 25 Working days of construction
SWS 12" PVC, CL-350 pipe To be relocated	Suburban Water System 1325 N Grand Ave Suite 100 Covina, CA 91724-4044	City of La Mirada South side of freeway on Valley View Ave, from STA "VAL" 84+85 to 91+18 (U-22)	30 days of Notice to Owner. 14 Working days of construction
SWS 12" PVC, CL-350 pipe To be relocated	Suburban Water System 1325 N Grand Ave Suite100 Covina, CA 91724-4044	City of La Mirada Southeast of Valley View Ave and rail road from STA "VAL" 91+18 to Firestone Blvd STA "SFIR1" 57+14.15 (U-22 & U-20)	30 days of Notice to Owner. 11 Working days of construction
SWS 12" PVC, CL-350 pipe To be relocated	Suburban Water System 1325 N Grand Ave Suite 100 Covina, CA 91724-4044	City of La Mirada South side of freeway on Firestone Blvd from STA 57+14.15 to 19+30 (U-17, U-18, U-19, & U-20)	30 days of Notice to Owner. 85 Working days of construction
SWS 16" PVC CL-350 pipe and 20" Steel Casing To be relocated	Suburban Water System 1325 N Grand Ave Suite 100 Covina, CA 91724-4044	City of La Mirada Freeway crossing extend the 20" Steel casing to New Firestone Blvd and replace existing 16" steel pipe to 16" PVC CL-350 to STA "SFIR1" 55+22 (U-20)	30 days of Notice to Owner. 10 Working days of construction
SWS 12" PVC CL-350 pipe and 16" Steel Casing To be relocated	Suburban Water System 1325 N Grand Ave Suite 100 Covina, CA 91724-4044	City of La Mirada Freeway crossing extend the 16" Steel casing to New Firestone Blvd , and replace existing 12" steel pipe to 12" PVC CL-350 to STA "SFIR1" 30+42 (U-17)	30 days of Notice to Owner. 11 Working days of construction

City of Cerritos 12" Ductile Iron Pipe (DIP) CL-350 CC To be relocated	City of Cerritos 18125 Bloomfield Ave. P.O. Box 3130 Cerritos, CA 90703	City of Cerritos West Side of Valley View (U-22, U-22)	30 days of Notice to Owner. 30 Working days of construction
SCE pole #, PP2275985E, PP4679784E, PP2216044E, PP2276168E, PP1541694E, PP2276169E, PP2275890E, PP4679785E, PP2276170E, PP4578995E, PP2275554E, PP2062305E, PP1040322H TP1949714E, TP1402784E	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Firestone Blvd to be relocated (U-14)	30 days of Notice to Owner. 40 Working days of construction
SCE 66KV 6-5" conduit from V-TM4434 to New Transmission Pole is proposed	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	Knott Ave and North Firestone Blvd (U-14)	
SCE 66KV 6-5" conduit crossing Freeway at Knott Ave, Caltrans provide utility opening at RW-No-2 to protect in place	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	Knott Ave and North Firestone Blvd (U-14)	
SCE 12KV, 4-5" & 1-5" conduit 172', 5' North of "NFIR1", SCE M5642345 (6'X12"X7)' MH, SCE 12KV 2-5" & 6-5", 118' Conduit, 6' W of "KNO", to V5636366 Vault SCE 12KV 1-5", 27' conduit from V5636366 Vault at Sta 14+20 "KNO", SCE 12KV 1-5" & 4-5", 57' conduit, 5' W of "KNO" From V5636366 Vault SCE 12KV 1-5" & 4-5", 91' conduit at Sta 14+91 "KNO" and SCE 12KV 2-5", 194' conduit from M5642345 Manhole to PP2275554E Proposed	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	Knott Ave and North Firestone Blvd (U-14)	30 days of Notice to Owner. 10 Working days of construction

Paramount Petroleum Oil, 6" in 12" casing and 12" in 20" casing crossing I-5 at Knott Ave, contractor to provide utility opening for RW No 2 per structural design	Paramount Petroleum 14700 Downey Ave. Paramount, CA 90723	Knott Ave and North Firestone Blvd (U-14).	5 days of Notice to Owner prior to commencement of construction.
SCE pole #, PP4422376E, PP1994089E, PP2062308E, PP2062309E, PP625515H PP1353090E, PP4453080E, PP625517H PP4805003E, PP2218789, PP4401918E, PP4401922E, PP1994089E, PP1353090E, PP4221487E	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Firestone Blvd (U-15)	30 days of Notice to Owner. 20 Working days of construction
SCE 12KV, 1-4", 201' conduit from Sta 6+54 to Sta 8+15 of I-5 Centerline to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Firestone Blvd (U-15)	
SCE 12KV, 153' 1-4" conduit from PP 1353090E along Osmond Way to P5179057 Slab Box to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Firestone Blvd (U-15)	
SCE 12KV, 400', 4-4" from P5179057 Slab Box to HO57A Concrete to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Firestone Blvd (U-15)	

SCE pole #, PP4221487E, PP2062559E, PP2062560E, PP4248402E, PP5127295E PP4085091E, PP1075734E, PP1004984H PP4437137, PP4437138E, PP4437139, PP4437140E, PP4437135E, PP4437133E, PP4437131, PP4437129E, PP4437127E, PP4437125E	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Firestone Blvd (U- 16),	30 days of Notice to Owner. 120 Working days of construction
SCE 12KV, 1-5" conduit 134' from PP 4221487E to V5420573 Vault to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Firestone Blvd (U- 16)	
SCE 12KV, 1-4" conduit 164' from V5420573 Vault to P5127295 Slab Box to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Firestone Blvd (U- 16)	
P5127295 Slab Box 12KV to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Firestone Blvd (U- 16)	
SCE 12KV, 1-3", 225' conduit from V5420573 Vault to SCE HH to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Firestone Blvd (U- 16)	
SCE 12KV, 2-5", 1- 4", 516' conduit from V5420573 to V5420569 Vault (U- 16) to be removed	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Firestone Blvd (U- 16)	
SCE 12KV, 2-5" conduit 166' from PP 4221487E to V5628178 Vault (U- 16) Proposed	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Firestone Blvd (U- 16)	
SCE 12KV, 4-5", 569' conduit from V5628178 Vault to V5640055 Vault (U- 16) Proposed	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North & South side of freeway on Firestone Blvd (U-16)	
SCE 12KV, 2-4", 4- 5", 37' conduit from V5640055 Vault to V5420569 Vault (U- 16) Proposed	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North & South side of freeway on Firestone Blvd (U-16)	

SCE 12KV, 1-5", 658' conduit from V5420569 Vault to V5502479 Vault to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North & South side of freeway on Firestone Blvd (U-16)	
SCE 12KV, 1-5" conduit, 69' from V5420570 Vault to X5420571 Vault (U- 16) to remain	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Firestone Blvd (U- 16)	
SCE 12KV, 4-5" conduit, 342' from V5420570 Vault to V5420569 Vault crossing Freeway (U-16) to remain	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	Crossing I-5 at Coyote Creek (U-16)	
SCE #, PP4085091E, 2062559, 4085091E, PP1004983H, PP1004984H, PP4085091E, PP1075731E, PP2062560E, PP833010E, PP823983H, PP2314775E, PP398196E, PP1398195E, PP1752354E, PP4007118E, PP1352609E, PP4745464E, PP1021312H, PP833007E, PP2275537E, PP4805006E, PP1398196E, PP2062561E, PP4745464E, PP4401925E, PP4445620E, PP1752354E	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Firestone Blvd (U- 17)	30 days of Notice to Owner. 30 Working days of construction
SCE 12KV, 1-4" conduit 57' from PP 833010E to X5628177 Pull Box (U-17) to be removed by others	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Firestone Blvd (U- 17)	
PP4437135E, PP4437133E, PP4437131E, PP4437129E, PP44237127, PP447125E	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Firestone Blvd (U- 17)	

SCE 12KV V5502477, Vault at Sta 76+57 North Firestone centerline (U-17) to remain	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Firestone Blvd (U- 17)	
SCE pole #, PP4053569E, PP833006E, PP2275551E, PP231477E, PP833005E, PP231777E, PP4284749E, PP1263087E, PP231776E, PP4126154E, PP4126159, PP1021332H	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Firestone Blvd (U- 18)	30 days of Notice to Owner 30 Working days of construction
P5125974 Slab Box 12KV (U-18) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Firestone Blvd (U- 18)	
SCE 12KV, 1-4" conduit 133' from PP 833006E to P5125974 Slab Box (U-18) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Firestone Blvd (U- 18)	
SCE pole #, PP1263087E, PP833002E, PP454866E, PP1227240E, PP1752766E, PP2317795E, PP4745463, PP1153942E, PP5399425, PP4023978E, PP1752400E, PP4401927E		South side of freeway on Firestone Blvd (U- 19)	30 days of Notice to Owner 30 Working days of construction
SCE X5399424 Pull Box 12KV (U-20) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Firestone Blvd (U- 20)	
SCE 12KV 4-4" conduit 50' from X5399424 Pull Box to Slab Box (U-20) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Firestone Blvd (U- 20)	
SCE P5399423 Slab Box 12KV (U-20) to be removed by others	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Firestone Blvd (U- 20)	

SCE 12KV 1-4" conduit 726' from P5399423 Slab Box to P539945 Slab Box (U-19, U-20) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Firestone Blvd (U-19, U-20)	
SCE pole #, PP1466481E, PP4556394E, PP1153938E, PP4468903E, PP1994206E, PP1300937E, PP1300936, PP1300935E, PP1300934E, PP1300933E, PP4401929E, PP4468903E, PP4402697, PP4556394E, PP4832058E, PP4832060E, PP4528092E, PP4528092E, PP4832059E	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Firestone Blvd (U-20)	30 days of Notice to Owner 30 Working days of construction
SCE 12KV, 1-4" conduit 162' from PP 1300936E to P5127281 Slab Box (U-20) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Firestone Blvd (U-20)	
SCE P5127281 Slab Box & P5127283 12KV (U-20) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Firestone Blvd (U-20)	
SCE 12KV, 1-4" conduit 204' from P5127281 Slab Box to P5127283 Slab Box (U-20) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Firestone Blvd (U-20)	
SCE pole #, PP1752346E, PP1752347E PP4814903E (U-21)	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Freeway Drive (U-21)	10 Working days of construction
SCE 12KV, 1-4" conduit 487' from PP 1752346E to P5058512 Slab Box (U-21) to be removed by others	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Freeway Drive (U-21)	
SCE P5058512 Slab Box 12KV (U-21) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Freeway Drive (U-21)	

SCE P5127284, P5127285, P5127286, & P5127287 utility boxes 12KV (U-21) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Freeway Drive (U-21)	
SCE 12KV, 1-4" conduit 1074' from P5127283 Slab Box to P5127287 Slab Box (U-21) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway on Firestone Blvd (U-21)	
SCE pole #, PP1915769E, PP1915770E, PP4832061E, PP2167939E, PP1915771E, PP1915772E, PP1915775E, PP1915774E, PP1915773E, PP2276303E, PP4658051E, PP1852689E, PP2276301E, PP1982887E (U-22)	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Valley View Ave. (U-22)	30 days of Notice to Owner 20 Working days of construction
SCE 12KV, 1-4" conduit 150' from PP 1915775E to P5203777 Slab Box (U-22) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Valley View Ave. (U-22)	
SCE P5203777 Slab Box & X5399420 Pull Box 12KV (U-22) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Valley View Ave. (U-22)	
SCE 12KV, 1-4" conduit 22' from X5399420 Pull Box to New X5636097 Pull Box (U-22) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Valley View Ave. (U-22)	
SCE 12KV, 1-4" conduit 116' from P5165046 Slab Box to Split" Y" at Sta 86+65 "VAL" (U-22) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Valley View Ave. (U-22)	
SCE 12 KV, 1-4" conduit, 4' from PP 1915770E to New X5636388 Pull Box at Sta 83+23 "VAL" (U-22) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Valley View Ave. (U-22)	

SCE 12 KV, 1-4" conduit, 8' from PP 1915769E to New X5636095 Pull Box at Sta 81+35 "VAL" (U-22) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	South side of freeway on Valley View Ave. (U-22)	
SCE pole #, PP1300932E, PP1300931E, PP1300929E, PP4456681E, PP1300927E, PP1300926E, PP1320907E, PP1113691E, PP1113690E, PP1113689E, PP1655054E, PP4832056E, PP4832055E, PP4456681E, PP4274029E, PP4274028E, PP4274019E, PP4274018E, PP4832054E, PP4832053E, PP4832052E, 4832051E	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway along Valley View and Firestone to Valley View Avenue (U-23)	30 days of Notice to Owner 20 Working days of construction
SCE 12KV, 1-4" conduit 170' from PP 1300929E to P5411759 Slab Box (U-23) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway along Valley View Ave. and Firestone Blvd. to Valley View Avenue (U-23)	
SCE 12KV, 1-4" conduit 136' from PP 1300931E to P5411759 Slab Box (U-23) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway along Valley View and Firestone Blvd. to Valley View Avenue (U-23)	
SCE 12KV, 1-5" conduit 50' from PP 1113691E to M5194771 Manhole (U-23) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway along Valley View Ave. and Firestone Blvd. to Valley View Avenue (U-23)	
SCE 12KV, 1-4" conduit 502' from M5194771 Manhole to V5194770 Vault (U-23) to be abandoned	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	North side of freeway along Valley View Ave. and Firestone Blvd to Valley View Avenue (U-23)	
City of Buena Park , Street Lights	SCE 1444 E McFadden Ave. Santa Ana, CA 92705	City of Buena Park, on Firestone Blvd, from Artesia to Knott Ave	30 day of Notice to Owner 30 Working days of construction

City of La Mirada, Street Lights, (LA County Department of Public Work, Street lighting and Traffic Signals)	City of La Mirada 15515 Phoebe Ave. LA Mirada, CA 90638	North & South side of freeway on Firestone Blvd	30 day of Notice to Owner 60 Working days of construction
City of Cerritos, Street Lights	City of Cerritos 18125 Bloomfield Ave. P.O. Box 3130 Cerritos, CA 90703	City of Cerritos West Side of Valley View	30 day of Notice to Owner 30 Working days of construction
SCG, 4" P-M, 6" P-M, 2" P-M to be relocated	SCG 1919 S State College Blvd. Anaheim, CA 92806	North side of freeway along East of Valley View STA "VAL" 109+45 to "NFIR1" 65+33, A-230' of 6" P-M, A-395' of 4" P-M, I-641' of 6" P-M, West of Valley View I-159' of 2" P-M (U-10, U-23)	30 day of Notice to Owner 35 Working days of construction
SCG, 2" M, 3" M, 4" M, 6" M to be relocated	SCG 1919 S State College Blvd. Anaheim, CA 92806	South side of freeway along Firestone Blvd I-3210' 3"P-M, A-970' 6"M, A1060', A-1630' 3"M, A-169' 2" PEM (U-4 to U-7, U-17 to U-20), Freeway Crossing at STA 51+59 A-80' 6"M	30 day of Notice to Owner 45 Working days of construction
SCG, 2" M, 3" M, 4" M to be relocated	SCG 1919 S State College Blvd. Anaheim, CA 92806	South side of freeway Rail Road crossing to Valley View and along Valley View I-1168' 4" P-M A-653' 4"M, Along Arbor Pl, I-434' 2" PEM A-186' 3"M, A-207' 2" M (U-7, U-9, U-20 to U22)	30 day of Notice to Owner 20 Working days of construction
SCG, 3" P-M to be relocated	SCG 1919 S State College Blvd. Anaheim, CA 92806	South side of freeway along Firestone Blvd I-1820' of 3" P-M (U-7, U-8)	30 day of Notice to Owner 30 Working days of construction
AT&T California, Install - 470' 6-4" DU, 11' 2-4" DU, 304' 4-4" DU, 25' 8-4" DU, 21' 8-4" DU, 11' 4-4" DU, 16' 4-4" DU, 137' 4-4" DU, 3'X5'X4' pullbox, 12'x6'x7' MH, Abandon - 281' 1-4" DU, 95' 2-4" DU, 7' 1-4" DU	AT&T 600 E Green Street Pasadena, CA 91101	North side of freeway on Firestone Blvd, and West Corner of Knott Ave (U-1, U-14)	30 day of Notice to Owner 60 Working days of construction

ATT&T California, Install - 26' 8-4" DU, 33' 4-4" DU, 66' 4-4" DU, 46' 4-4" DU, 165' 5-4" DU, 279' 6- 4" DU, 30' 11-4" DU, 46' 15-4" DU, 162' 3- 4" DU, 21' 1-4" DU, 20' 4-4" DU, 32' 4-4" DU, 72' 9-4" DU, 160' 8-4" DU, 3'X5'X4' pullbox, 3- 12'x6'x7' MH, Abandon - 115' 7-4" du, 115' 10-4"DU, 109' 8-4" DU, 19' 1- 4" DU, 143' 7-4" DU, 98' 9-4" DU, 42' 1-4" DU, 22' 2-4" DU, 34' 6-4" DU	AT&T 600 E Green Street Pasadena, CA 91101	North side of freeway on Firestone Blvd, and connections on South side of freeway (U-3, U-16)	30 day of Notice to Owner 60 working days of Construction
ATT&T California, Install-290' 3-4" DU, 268' 1-4" DU, 94' 4- 4" DU, 25' 3-4" DU, 82' 7-4" DU, 43' 7-4" DU, 11' 4-4" DU, 17' 3-4" DU, 12'X6'X7' MH, Abandon - 17' 1-4" DU, 19' 1-4" DU, 15' 1-4" DU, 181' 2-4" DU, 370' 1- 4" DU	AT&T 600 E Green Street Pasadena, CA 91101	South side of freeway on Firestone Blvd (U- 6, U-7, U-19, U-20)	30 day of Notice to Owner 60 working days of Construction
Verizon California, 1164' 4-4" Sch-40 PVC, Two Manholes 4'-6"X8'-6"X6'-6" and 5'X10'X6'-6" Relocate	12905 E. Los Nietos Rd. Santa Fe Springs, CA 90670	South side of I-5 Freeway, along S Firestone Blvd (U-7,U- 8, U-20, U-21)	30 days of Notice to Owner 15 working days on Construction
Verizon California, Crossing RR 120' 12" Steel Casing; 635' 4-4" Sch-40 PVC; 5' 8-4" Sch-40 PVC; Place MH 5'X10'X6'6";	12905 E. Los Nietos Rd. Santa Fe Springs, CA 90670	South side of I-5 Freeway, Crossing RR and to Valley View Blvd (U-7,U-9, U-20, U-22)	15 working days on Construction
Verizon California 625' 4-4" Sch-40 PVC, 96' 2-4" Sch- 40 PVC; MH 5'x10.5'x6.5', 3'x5'x4'; Relocate	12905 E. Los Nietos Rd. Santa Fe Springs, CA 90670	South side of I-5 Freeway, along Valley View Ave	30 day of Notice to Owner 10 working days on Construction
Verizon California; 109' 1-4" Sch-80 PVC, 684' 2-4" Sch- 40 PVC;3-3'X5"X4 PB' 255' 2-4" Sch- 40;2'x3' HH Relocate	12905 E. Los Nietos Rd. Santa Fe Springs, CA 90670	North side of I-5 Freeway along East side of Valley View Ave	30 day of Notice to Owner 10 working days on Construction

Time Warner Cable Underground	Time Warner Cable 14338 Lakewood Blvd. Bellflower, CA 90706	North side of I-5 Freeway along North Firestone Blvd STA "NFIR1" 44+80 to STA "NFIR1" 69+77 (U-1 to U-4, U-14 to U-17)	30 day of Notice to Owner 10 working days on Construction
Time Warner Cable underground	Time Warner Cable 14338 Lakewood Blvd. Bellflower, CA 90706	North side of I-5 Freeway along Valley View Ave (U-7, U-10, U-20, U-23)	30 day of Notice to Owner 10 working days on Construction
Time Warner Cable underground	Time Warner Cable 14338 Lakewood Blvd. Bellflower, CA 90706	South side of I-5 Freeway along south Firestone Blvd (U-3 to U-6, U-16 to U-19)	30 day of Notice to Owner 10 working days on Construction
Chevron, 8" Crude Oil line, Active	2600 Homestead P. Rancho Dominguez, CA 90220	Cross the Freeway at Trojan Way (U-3, U- 16)	45 days of Notice to Owner 221 Working days of construction
Crimson, 8" Crude Oil line, Active and 6" Dry Gas line, idle	Crimson CA Pipeline, LP 2459 Redondo Ave. Long Beach, CA 90755	Cross the Freeway at Trojan Way (U-3, U- 16)	45 days of Notice to Owner 221 Working days of construction

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

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

Utility	Location
SCE 66KV Transmission Line Overhead	Valley View Ave. and Route 5 intersection
Verizon California, 1303' 4-4" Sch-40 PVC	Valley View Ave. and Route 5 intersection
SCG, 4" P-M, 6" P-M, 2" P-M	Valley View Ave. and Route 5 intersection
SWS 12" ACP	Valley View Ave. and Route 5 intersection
SWS 12" ACP	Coyote Creek and Route 5 Intersection
SWS 16" Steel casing and 20" steel casing	Route 5 crossing and SB on ramp from Valley View Ave. under retaining walls 52 and 55
SWS 20" Steel casing	Valley View Ave. under retaining wall VA-88
SCE 12KV 4-5" conduit 569'	Coyote Creek and Route 5 Intersection
AT &T California 5-4" DU	Coyote Creek and Route 5 Intersection
Time Warner Cable, 205' (3)-4" CU with (3)-1 1/4" Inner ducts (TWC) in 12" steel Casing	Coyote Creek and Route 5 Intersection
Chevron, 8" Crude Oil line, Active	Coyote Creek and Route 5 Intersection
Crimson, 8" Crude Oil line, Active and 6" Dry Gas line, idle	Coyote Creek and Route 5 Intersection

The utilities shown in the following table will not be rearranged. The utilities may interfere with pile driving, drilling activities, or substructure construction. If you want any of them rearranged or temporarily deactivated, make arrangements with the utility owner.







# 11 QUALITY CONTROL AND ASSURANCE

Replace section 11-4 with:

## 11-4 CAST-IN-PLACE STRUCTURAL CONCRETE MATERIALS

### 11-4.01 GENERAL

#### 11-4.01A General

Section 11-4 applies to CIP structural concrete members constructed under sections 49 or 51 except for those members constructed of minor concrete.

Quality control and assurance for CIP structural concrete materials includes:

1. Your QC program
2. Acceptance of the concrete by the Engineer using the Department's test results and verified QC test results

#### 11-4.01B Definitions

**lot:** quantity represented by the specified minimum QC testing frequency.

### 11-4.02 QUALITY CONTROL

#### 11-4.02A General

Develop, implement, and maintain a QC program that includes inspection, sampling, and testing of structural concrete materials.

For each ASTM test method specified in this section, the materials must comply with the requirements specified for the comparable test in section 90 unless otherwise specified.

#### 11-4.02B Quality Control Manager

Assign a QC manager. The QC manager must have one of the following qualifications:

1. Civil engineer license in the State of California
2. ACI Concrete Laboratory Testing Technician, Level 1 certification
3. NICET Level II concrete certification
4. ICC Reinforced Concrete Special Inspector certification
5. ASQ Certified Quality Manager

During concrete placement, the QC manager must be at the plant or job site within 3 hours of receiving notification from the Engineer.

#### 11-4.02C Testing and Inspection Personnel

QC laboratory testing personnel must have an ACI Concrete Laboratory Testing Technician, Level 1 certification or an ACI Aggregate Testing Technician, Level 2 certification, whichever certification includes the test being performed.

QC field testing personnel and field and plant inspection personnel must have an ACI Concrete Field Testing Technician, Grade I certification.

#### 11-4.02D Testing Laboratories

Each QC testing laboratory must be an authorized laboratory and have a current accreditation from the AASHTO Accreditation Program for the tests performed.

#### 11-4.02E Concrete Plants

Each concrete plant must:

1. Have a current certification for ready mixed concrete production facilities from the National Ready Mixed Concrete Association. Plant Certification Checklist and supporting documentation must be available for review by the Engineer upon request.
2. Be tested and authorized under California Test 109.

#### **11-4.02F Quality Control Meeting**

Before submitting the QC plan, hold a meeting to discuss the requirements for structural concrete QC. The meeting attendees must include the Engineer, the QC manager, and at least 1 representative from each concrete plant.

#### **11-4.02G Submittals**

##### **11-4.02G(1) Quality Control Plan**

The QC plan must detail the methods used in your QC program to ensure the quality of the work and to provide the controls necessary to produce concrete that complies with the Contract. The QC plan must include the following:

1. Names and documentation of certification or accreditation of the concrete plants and testing laboratories to be used
2. Names, qualifications, and documentation of certifications for the QC manager and all QC testing and inspection personnel to be used
3. Organization chart showing QC personnel and their assigned QC responsibilities
4. Example forms, including forms for certificates of compliance, hard copy test result submittals, and inspection reports
5. Methods and frequencies for performing all QC procedures, including inspections and material testing
6. Procedures to control quality characteristics, including standard procedures to address properties outside of the specified operating range or limits and example reports to document nonconformances and corrective actions taken
7. Procedures for verifying:
  - 7.1. Materials are properly stored during concrete batching operations
  - 7.2. Batch plants have the ability to maintain the concrete consistency during periods of extreme heat and low temperature ranges
  - 7.3. Admixture dispensers deliver the correct dosages within the accuracy requirements specified
  - 7.4. Delivery trucks have a valid NRMCA certification card
8. Procedures for verifying that the weighmaster certificate for each load of concrete shows:
  - 8.1. Concrete as batched complies with the authorized concrete mix design weights
  - 8.2. Moisture corrections are being accurately applied to the aggregates
  - 8.3. Cement and supplementary cementitious materials are from authorized sources
  - 8.4. Any hold back mix water
  - 8.5. Weighmaster signature
9. Procedures for visually inspecting the concrete during discharge operations

Submit 3 copies of the QC plan for review.

Allow the Department 42 days to review the QC plan.

Submit an amended QC plan or an addendum to the QC plan if there are any changes to:

1. Concrete plants
2. Testing laboratories
3. Plant certification or laboratory accreditation status
4. Tester or inspector qualification status
5. QC personnel
6. Procedures and equipment

Allow the Department 5 days to review an amended QC plan or an addendum to the QC plan.

Submit 4 copies of each authorized QC plan and make 1 copy available at each location where work is performed.

##### **11-4.02G(2) Concrete Mix Design**

In addition to the mix design submittal requirements specified in section 90, submit with your mix design the results from the tests specified in section 11-4.02H and the results from the tests shown in the following table:

Characteristic	ASTM Test Method
Specific gravity and absorption of aggregates	C127 and C128
Durability index for fine aggregate	D3744/D 3744M
Soundness	C88 (use sodium sulfate)
Loss after 500 revolutions	C131
Organic impurities	C40/C 40M
Chloride concentration of water for washing aggregates and mixing concrete	D512 or C114 <sup>a</sup>
Sulfate concentration of water for washing aggregates and mixing concrete	D516 or C114 <sup>a</sup>
Impurities in water for washing aggregates and mixing concrete	C191 or C266 C109/C109M

<sup>a</sup>To adapt the test methods in ASTM C 114 to testing water, use a water sample instead of the cement solution specified and adjust the test procedure accordingly.

The test results must be dated within 1 year of submission of the concrete mix design.

Each mix design must be prequalified under section 90-1.01D(5)(b).

#### **11-4.02G(3) Test Results**

Submit QC test results within 1 business day of completing each test.

Within 3 business days of completing each QC test, submit the test results electronically at the following Web site:

<http://www.dot.ca.gov/hq/esc/Translab/DIME/>

A unique test sample identification number must be given to each sample in compliance with the instructions provided at the website above.

Include the following with the test results:

1. Contract number
2. Mix design number
3. Test sample identification number
4. Date and time of test
5. Batch plant
6. Batch number
7. Bridge number and description of element
8. Test results
9. Any supporting data and calculations
10. Name, certification number, and signature of the QC tester

#### **11-4.02G(4) Inspection Reports**

Document each inspection performed by a QC inspector in an inspection report that includes:

1. Contract number
2. Mix design number
3. Date and time of inspection
4. Plant location
5. Concrete placement location
6. Batch number
7. Reviewed copies of weighmaster certificates
8. Description of the inspection performed
9. Name, certification number, and signature of the QC inspector

Include the inspection reports in the concrete materials QC summary report.

#### 11-4.02G(5) Concrete Materials Quality Control Summary Report

During concrete production, submit a concrete materials QC summary report at least once a month. The report must include:

1. Inspection reports
2. Test results
3. Documentation of the following:
  - 3.1. QC manager has evaluated all test results
  - 3.2. Problems or deficiencies discovered and the corrective actions taken
  - 3.3. Any testing of repair work performed
  - 3.4. List and explanation of deviations from the specifications or regular practices
4. Certificate of compliance signed by the QC manager. The certificate must state that the information contained in the report is accurate and the materials comply with the Contract.

#### 11-4.02H Quality Control Procedures

Perform all sampling, testing, and inspecting required to control the process and to demonstrate compliance with the Contract and the authorized QC plan.

Provide a QC field inspector at the concrete delivery point while placement activities are in progress. Provide a testing laboratory and testing personnel for QC testing.

Provide the Department unrestricted access to the QC activities.

For each mix design, perform sampling and testing in compliance with the following two tables:

#### Aggregate QC Tests

Quality Characteristic	ASTM Test Method	Minimum Testing Frequency
Aggregate gradation	C136	Once per each day of pour
Sand equivalent	D2419	Once per each day of pour
Percent fines under 75 microns <sup>a</sup>	C117	Once per each day of pour
Moisture content of fine aggregate <sup>b</sup>	C566	1–2 times per each day of pour, depending on conditions

<sup>a</sup>Percent fines under 75 microns test replaces the cleanness test in section 90-1.02C with 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.

<sup>b</sup>Moisture content must be within half a percent of the value shown on the weighmaster certificate.

### Concrete QC Tests

Quality Characteristic	ASTM Test Method	Minimum Testing Frequency
Slump <sup>a</sup>	C143/C143M	Once per 100 CY or each day of pour, whichever is more frequent, and whenever the consistency is in question
Uniformity	C143/C143M and C685/C685M, section A1.10	Whenever the uniformity of the concrete is in question or when requested by the Engineer
Air content, (freeze-thaw area)	C231/C231M or C173/C173M <sup>b</sup>	If concrete is air entrained, once per 30 CY or each day of pour, whichever is more frequent
Air content	C231/C231M or C173/C173M <sup>b</sup>	If concrete is air entrained, once per 100 CY or each day of pour, whichever is more frequent
Temperature	C1064/C1064M	Once per 100 CY or each day of pour, whichever is more frequent
Density	C 138	Once per 100 CY or each day of pour, whichever is more frequent
Compressive strength <sup>c,d,e</sup>	C172/C172M, C31/C31M, and C39/C39M	Once per 100 CY or each day of pour, whichever is more frequent

<sup>a</sup>The requirements in section 90-1.02G(6) apply, except slump testing must be used. The slump must be from 1 to 4 inches nominal range and 6 inches maximum value for elements that are 12 inches thick or less and from 1 to 3 inches nominal range and 5 inches maximum value for elements that are over 12 inches thick.

<sup>b</sup>ASTM C173/C173M must be used for lightweight concrete.

<sup>c</sup>Cylinders must be 6 by 12 inches.

<sup>d</sup>Mark each cylinder with the Contract number; the date and time of sampling; and the weighmaster certificate number.

<sup>e</sup>At a minimum, test for compressive strength at the maximum time allowed. You may need additional test samples to facilitate your schedule.

For at least 3 years after final acceptance, retain for review the records generated as part of QC including inspection, sampling, and testing.

#### 11-4.03 DEPARTMENT ACCEPTANCE

##### 11-4.03A General

The Department accepts structural concrete based on the following:

1. Verified QC test results
2. Department's test results

##### 11-4.03B Verification Sampling And Testing

###### 11-4.03B(1) General

The Department performs verification testing of the QC tests for the following quality characteristics:

1. Slump
2. Air content
3. Compressive strength

The ratio of verification testing frequency to the minimum QC testing frequency is 1:3.

###### 11-4.03B(2) Verification

The Department performs verification testing by taking a separate sample from the same load of concrete that you take a sample from for the QC test. The Department determines which load of concrete to be used for verification testing.

The Department uses the same test methods for verification testing as those specified for QC testing.



Keep construction project funding signs clean and in good repair at all times.

### **12-2.02 MATERIALS**

Construction project funding signs must be wood post signs complying with section 56-4.

Sign panels for construction project funding signs must be framed, single sheet aluminum panels complying with section 56-2.

The background on construction project funding signs must be Type II retroreflective sheeting on the Authorized Material List for signing and delineation materials.

The legend must be retroreflective, except for nonreflective black letters and numerals. The colors blue and orange must comply with PR Color no. 3 and no. 6, respectively, as specified in the Federal Highway Administration's *Color Tolerance Chart*.

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

HIGHWAY CONSTRUCTION

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

FEDERAL HIGHWAY TRUST FUNDS

STATE HIGHWAY FUNDS

METRO LOCAL FUNDS

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

YEAR OF COMPLETION 2020

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

### **12-2.03 CONSTRUCTION**

Install 2 Type 2 construction project funding signs at the locations designated by the Engineer before starting major work activities visible to highway users.

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

### **12-2.04 PAYMENT**

Not Used

#### **Add to section 12-3.12C:**

Start displaying the message on the portable changeable message sign 5 minutes before closing the lane.

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

#### **Replace "Reserved" in section 12-3.13 with:**

### **12-3.13A General**

#### **12-3.13A(1) Summary**

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

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

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

The impact attenuator vehicle must comply with the attenuator manufacturer's instructions for:

1. Support truck, except the weight of the support truck must comply with the allowable vehicle weight limits shown on the Authorized Materials List for highway safety features and the manufacturer's instructions
2. Trailer-mounted attenuator
3. Truck-mounted attenuator

Flashing arrow signs must comply with section 12-3.03 except you may use a portable changeable message sign instead of a flashing arrow sign. If a portable changeable message sign is used as a flashing arrow sign, it must comply with section 6F.61 "Arrow Panels" of the *California MUTCD*.

#### **12-3.13A(2) Definitions**

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

#### **12-3.13A(3) Submittals**

Submit a certificate of compliance for each attenuator used on the project.

#### **12-3.13A(4) Quality Control and Assurance**

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

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

#### **12-3.13B Materials**

Impact attenuator vehicles must be on the Authorized Materials List for highway safety features. Impact attenuator vehicles must comply with Veh Code Div 12.

Each attenuator must be individually identified with the manufacturer's name, address, attenuator model number, and a specific serial number. The name and number must be a minimum 1/2 inch high and located on the left, street side, lower front corner. Do not use an attenuator that is damaged or appears to be in poor condition until it is recertified by the manufacturer. The Engineer determines if a used attenuator supplied under this Contract needs to be recertified. Each unit must be certified by the manufacturer to comply with the requirements for an attenuator under the standards established by the Department's Division of Research, Innovation and System Information.

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

Each impact attenuator vehicle must have:

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

#### **12-3.13C Construction**

Do not start impact attenuator vehicle activities until authorized.

Except where prohibited, use an impact attenuator vehicle:

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

Monitor placement and use of the attenuator vehicle on a regular basis and adjust the use of the attenuator to match changing field conditions as construction progresses.

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

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

Do not use a damaged attenuator. Replace any attenuator damaged from an impact during work activities.

#### **12-3.13D Payment**

Not Used

#### **Replace section 12-3.14 with:**

#### **12-3.14 TEMPORARY TRAFFIC SCREEN**

##### **12-3.14A General**

Section 12-3.14 includes specifications for constructing temporary traffic screen.

##### **12-3.14B Materials**

Temporary traffic screen panels must be new or used, CDX grade or better, plywood or weather-resistant strandboard mounted and anchored on Type K temporary railing.

Wale boards must be new or used Douglas fir, rough sawn, construction grade or better.

Pipe screen supports must be new or used schedule 40, galvanized steel pipe.

Nuts, bolts, and washers must be cadmium plated.

Screws must be black or cadmium-plated flat head, cross-slotted screws with full thread length.

##### **12-3.14C Construction**

Mount and anchor temporary traffic screen on top of Type K temporary railing.

Remove the traffic screen from the highway when the Engineer determines it is no longer required. The traffic screen that is removed becomes your property.

A lateral move of Type K temporary railing with attached temporary traffic screen is change order work if ordered and the repositioning is not shown.

##### **12-3.14D Payment**

Not used.

#### **Replace section 12-3.16 with:**

#### **12-3.16 TEMPORARY SIGNAL SYSTEM**

##### **12-3.16A General**

Installing temporary signal system (TSS) consists of installing and maintaining temporary traffic signal and lighting.

The Department will furnish 1 Model 170E and Model 2070 traffic signal controller assembly, including wired cabinet, controller unit, and loop detector sensor units.

Furnish other materials and equipment for a TSS, including signal heads, mast arms, luminaires, wood poles, conductors, and hardware.

Material and equipment used in the TSS may be new or used but must be suitable for the intended use.

Orient each signal face to be clearly visible to traffic approaching from the direction that the signal is intended to control.

#### **12-3.16B Operation**

TSS must operate at nominal 120/240 V(ac). Lighting must operate at 240 V(ac).

Unless otherwise directed, the system must operate on a continuous, 24-hour basis except when it is necessary that traffic be controlled by flaggers.

The Department will perform timing for the TSS.

#### **12-3.16C Maintaining Temporary Signal System**

Except for the controller assembly, you are responsible for maintaining the TSS.

If components in the TSS are damaged, displaced, or cease to operate or function as specified from any cause during the progress of the work, immediately repair or replace the components, then restore to the original condition. Components include signs, generator, flashing beacons, and signal equipment.

If the TSS is out of operation, provide flaggers, at your expense, to maintain traffic control until the traffic signals are returned to service.

#### **12-3.16D Conduit**

At locations where conduit is required to be installed under pavement and if a delay to vehicles will not exceed 5 minutes, conduit may be installed by the trenching in pavement method as specified in section 86-2.05C.

#### **12-3.16E Conductors and Wiring**

Conductors must be the types specified in section 86-2.08 or Type UF cable of the size and number of conductors shown. The minimum conductor size must be no. 12.

If conductors are placed across paved areas, placement must comply with one of the following:

1. Place in a conduit
2. Suspend at least 25 feet above the roadway

Conductors placed outside of paved areas must be placed by one of the following methods:

1. Direct burial method with Type UF cable installed at a minimum depth of 24 inches below grade.
2. Placed in conduit. If Type 1 conduit is used, the minimum depth must be 12 inches. If Type 3 conduit is used, the minimum depth must be 18 inches.
3. Suspended from wood poles with a minimum clearance of 25 feet from grade at any point. Place the portions of the conductor installed on the face of wood poles in either Type 3 or Type 4 conduit.

Conductors placed across structures must be placed in a Type 1 conduit. Install the conduit on the outside face of the railing and secure by a method determined by the Engineer.

Conductors to a terminal compartment or signal head on a pole may be spliced to through conductors of the same phase in a pull box adjacent to the pole. Do not splice conductors or cables except in pull boxes or in NEMA Type 3R enclosures.

#### **12-3.16F Bonding and Grounding**

Comply with section 86-2.10.

Provide effective grounding for the generator.

#### **12-3.16G Service**

##### **12-3.16G(1) General**

Use a generator system with an additional generator as a backup to provide power for the TSS.

**12-3.16G(3) Generator**

Generators must be 120/240 V(ac), 60 Hz, 2.5 kW minimum, continuous duty type. Generators may be powered by gasoline, LPG, or diesel engines operating at approximately 1,800 rpm. Engines must have automatic oil feed. Generator systems must be equipped to provide automatic start-stop operation, with a 12 V starting system. Generator output circuits must have overcurrent protection with a maximum setting of 15 A or as shown.

Fuel storage must be sufficient for times when the generator system operates unattended.

Engines must be equipped with approved spark arrestors.

**12-3.16G(4) Generator Operation**

An automatic transfer switch must provide the following functions:

1. Line voltage monitoring and in the event of a power outage signal the generator to start.
2. Engine start delay, adjustable from 0 to 6 seconds, to prevent starting if the power outage is only momentary and an engine stop delay, adjustable from 0 to 8 minutes, to allow the generator set to run unloaded to cool before shut down.
3. Transfer delay of 0 to 120 seconds to allow the generator to stabilize before connecting to the load and retransfer delay of 0 to 32 minutes to allow the line voltage to stabilize.
4. "Load-No Load" switch to allow a test with or without load.
5. "Normal-Test" switch that will start and run the generator in the "Test" position. "Normal" position must return the generator to automatic operation.
6. Battery charger powered by the normal line voltage.
7. Generator voltage sensor that signals for a transfer if the generator output is ready.

Provide a mechanical interlock to prevent application of power to the load from both sources and to prevent backfeeding from the generator to the line.

The automatic transfer switch must be rated at 100 A, 120/240 V(ac), 3 wire, single phase and be compatible with the generator furnished.

**12-3.16H Department-Furnished Controller Assembly**

Construct the controller cabinet foundation as shown for Model 332L cabinets, including furnishing and installing anchor bolts. Install the controller cabinet on the foundation and make field wiring connections to the terminal blocks in the controller cabinet.

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

The Department or local forces will maintain all controller assemblies.

**12-3.16I Detectors**

Loop detector sensor units are Department-furnished as part of the controller assembly.

Loop detector lead-in cable must be Type B.

Comply with section 86-5.01A.

**12-3.16J Completion and Restoration**

Backfill pole holes.

The following materials may be abandoned in place when no longer required:

1. Conductors placed in slots across paved areas
2. Direct buried cables, installed 24 inches or more below the ground surface



**Replace the 1st paragraph of section 12-4.02A with:**

Work that interferes with traffic is limited to the hours when closures are allowed except for work shown on the stage construction and traffic handling plans.

**Delete the 2nd through 5th paragraphs of section 12-4.02A.**

**Replace the 6th paragraph of section 12-4.02A with:**

Submit a request for a minor deviation from the specified work hours at least 15 days before the proposed closure date. Your request may be authorized if (1) the Department does not accrue a significant cost increase and (2) the work can be expedited and better serve the traffic.

**Add to section 12-4.02A:**

If work, including installing, maintaining, and removing Category 3 traffic control devices except impact attenuator vehicles, is to be performed within 6 feet of the adjacent traffic lane, close the adjacent traffic lane.

Closure of the adjacent traffic lane is not required for installing, maintaining, and removing Category 1 and Category 2 traffic control devices.

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

The full width of the ramp traveled-way must be open for use by traffic on designated holidays.

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. and Columbus Day.

Not more than 1 stationary lane closure will be allowed per direction of travel at one time.

Work may be performed during the hours designated as "No work allowed" on charts no. 1 through 4 if temporary traffic screens are installed on top of the Type K temporary railings. Traffic screens are not allowed on the right side of traffic within the limits of a right horizontal curve with a radius of less than 2,000 feet as viewed in the direction of travel and on the left side of traffic within the limits of a left horizontal curve with a radius of less than 2,000 feet as viewed in the direction of travel. The Department does not pay for furnishing, installing, maintaining, or removing temporary traffic screen.

If traffic control is performed for a stationary lane closure where median shoulders are less than 8 feet, comply with the traffic handling details plan titled, "Traffic Control System for Median Shoulders Less Than 8 Feet," in addition to the specifications in sections 12-3.13 and 12-4.02.

HOV lanes may be closed any time the adjacent freeway lane is allowed to be closed as shown on charts no. 1 through 9.

Route 5 may be closed to traffic at 1 location in each direction of travel for falsework erection and removal, bridge demolition, striping, and loop detector installation operations. Comply with the hours and requirements shown on charts no. 5 through 9.

Except as otherwise specified, you may close the NB Route 5 Valley View Ave Off-ramp to reconstruct the roadway during Stage 3, Phase 2 for an extended period of time beginning at 2100 Friday through 0600 the following Monday instead of using chart no. 14. When the ramp is closed, place a portable changeable message sign for the entire closure duration as shown on the motorist information plan titled "Motorist Information Plan (Signing and PCMS Location) NB Route 5 Valley View Ave Off-ramp Extended Weekend Closure." Place a portable changeable message sign at a location on the ramp 14 continuous days before the date of planned closure with the following message:

Message type	Message
Weekends and Weekdays of 1st Week	Ramp / Will Be / Closed – MM-DD-YY / To / MM-DD-YY
Weekdays of 2nd Week	Ramp / Will Be / Closed – This / Weekend

Note:

"/" separates each line of text on the portable changeable message sign display.

"-" denotes where the portable changeable message sign display flashes the next line of text.

Except as otherwise specified on charts no. 12 through 17, other ramps may be closed if the adjacent freeway lane is allowed to be closed as shown on charts no. 1 through 11. If a ramp is closed and a ramp lane requirement chart is not included, detour traffic to the next available ramp downstream of the closed ramp in the direction of travel. For each ramp closed, post at least 16 special portable freeway detour signs, SP-2, as shown on traffic handling details plan titled "Traffic Control System for Detour Sign Installation along Designated Detour Route," along the detour route and remove at the end of each closure.

Do not close on-ramps or off-ramps servicing 2 consecutive local street interchanges in the same direction of travel. The Engineer may authorize a closure if (1) you submit a request, (2) traffic will be better served, and (3) work will be expedited. If 2 or more consecutive on-ramps are allowed or are specified to be closed, install special signs for entrance ramp closures, SP-4, as shown. The Department does not pay for furnishing, installing, maintaining, or removing SP-4 signs. If an off-ramp is closed, install special signs for exit ramp closures, SP-3, and place the sign on the right shoulder of the freeway upstream of the preceding off-ramp.

If a ramp or connector closure is allowed, post a special advance notice publicity sign, SP-1, as shown at an authorized location, at least 7 days before the ramp or connector closure. Maintain accurate information on the sign and remove or cover the sign when work is not actively in progress.

Valley View Ave and Firestone Blvd (south of Route 5) may be completely closed for falsework installation and removal, bridge demolition, pavement striping, and temporary railing (Type K) installation and removal between the hours of 2200 and 0500 on weekdays and weekends. When Valley View Ave and Firestone Blvd (south of Route 5) are closed, public traffic must be detoured as shown on the Motorist Information Plans and Stage Construction/Traffic Handling Plans.

No work on city streets that interferes with public traffic is allowed to be performed between 0600 and 0900, or between 1530 and 2000. At all other times, a minimum of one paved traffic lane must be open for use by public traffic in each direction of travel, except as otherwise specified.

Access to business properties next to the construction zone must be maintained at all times, except as specified. You must inform owner or occupants of the adjacent business at least 5 days before the driveway is to be closed. Except as otherwise shown on the Stage Construction and Traffic Handling Plans, if a business has 2 or more driveways, only one driveway may be closed at a time. If a business

has only one driveway with a width greater than 20 feet, only one-half of the driveway may be closed at a time.

Personal vehicles of the Contractor's employees must not be parked within the right-of-way.

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

At each location where falsework is constructed over a street or route shown in the following table, provide openings through the bridge falsework. The type, minimum width, height, and number of openings at each location, and the location and maximum spacing of the falsework lighting, if required, must comply with the requirements shown in the following table. The width of vehicular openings is the clear width between temporary railings or other protective work.

Valley View Ave OH/OC (replacement) (Br. No 53-3045)  
I-5 NB & SB

	Number of openings	Width (feet)	Height (feet)
Vehicle openings (I-5 NB)	1	46	15
Vehicle openings (I-5 SB)	1	36	15
	Location	Spacing <sup>a</sup> (feet)	
Falsework pavement lighting (I-5 NB)	R and L	30 ft	
Falsework pavement lighting (I-5 SB)	R and L	40 ft staggered 1/2 space	

NOTE:

R = Right side of traffic

L = Left side of traffic

C = Centered overhead

<sup>a</sup>Spacing is the maximum distance from center to center between fixtures.

Valley View Ave OH/OC (replacement) (Br. No 53-3045)  
South Side Firestone Blvd

	Number of openings	Width (feet)	Height (feet)
Vehicle openings (stage 1 phase 1)	1	31	15
Vehicle openings (stage 2 phase 1)	1	46	15
	Location	Spacing	
Falsework pavement lighting (stage 1 phase 1)	R	22.5 ft	
Falsework pavement lighting (stage 2 phase 1)	R and L	22.5 ft with 8 ft shoulders	

NOTE:

R = Right side of traffic

L = Left side of traffic

C = Centered overhead

Valley View Ave OH/OC (replacement) (Br. No 53-3045)  
 South Side Firestone Blvd "temp 5"

	Number of openings	Width (feet)	Height (feet)
Vehicle openings	1	31	15
	Location		Spacing
Falsework pavement lighting	R and L		22.5 ft

NOTE:

R = Right side of traffic

L = Left side of traffic

C = Centered overhead

Valley View Ave OH/OC (replacement) (Br. No 53-3045)  
 Arbot PI / Valley View Ave

	Number of openings	Width (feet)	Height (feet)
Vehicle openings (WB Arbot)	1	64.5	15
	Location		Spacing
Falsework pavement lighting	R and L		22.5 ft with C 22.5' staggered 1/2 space

NOTE:

R = Right side of traffic

L = Left side of traffic

C = Centered overhead

Valley View Ave OH/OC (replacement) (Br. No 53-3045)  
 Arbot PI / private driveway

	Number of openings	Width (feet)	Height (feet)
Vehicle openings	1	24	15
	Location		Spacing
Falsework pavement lighting	R and L		22.5 ft

NOTE:

R = Right side of traffic

L = Left side of traffic

C = Centered overhead

Valley View Ave SB Off Ramp (Br. No 53-3058K)

	Number of openings	Width (feet)	Height (feet)
Vehicle openings	1	42	15
	Location		Spacing
Falsework pavement lighting	R and L		22.5 ft with 8 ft shoulders

NOTE:

R = Right side of traffic

L = Left side of traffic

C = Centered overhead

The Engineer determines the exact location of the openings.

**Delete the 1st paragraph of section 12-4.02B.**

**Add to the RSS for section 12-4.03B:**

For each 10-minute interval or fraction thereof past the time specified to open the closure, the Department deducts the amount for liquidated damages per interval shown in the table below. Liquidated damages are limited to 5 percent of the total bid per occurrence. Liquidated damages are not assessed if the Engineer orders the closure to remain in place beyond the scheduled pickup time.

Type of facility	Route	Direction	Period	Liquidated damages/interval (\$)
Mainline	5	NB	1st half hour	\$2,300 / 10 minutes
			2nd half hour	\$3,500 / 10 minutes
			2nd hour and beyond	\$4,600 / 10 minutes
Mainline	5	SB	1st half hour	\$1,200 / 10 minutes
			2nd half hour	\$1,800 / 10 minutes
			2nd hour and beyond	\$2,400 / 10 minutes

**Replace "Sunday" at each occurrence in the 1st paragraph of the RSS for section 12-4.03B with:**  
Friday

**Add to the RSS for section 12-4.03C:**

Submit a contingency plan for each of the following activities:

1. Activity requiring a full roadway closure
2. Bridge work
3. Bridge demolition
4. Falsework erection or removal, including adjustments
5. Striping

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

Replace "Reserved" in section 12-4.04 with:

Freeway or Connector Lane Closure Restriction for Designated Holidays and Special Days										
Thu	Fri	Sat	Sun	Mon	Tues	Wed	Thu	Fri	Sat	Sun
x	<b>H</b> xx	xx	xx							
x	xx	<b>H</b> xx	xx							
	x	xx	xx	<b>H</b> xx						
	x			<b>SD</b> xx						
				x	<b>H</b> xx					
					x	<b>H</b> xx				
						x	<b>H</b> xx	xx		xx
Legend:										
	Refer to Charts no. 1 to 11.									
x	The full width of the traveled way must be open for use by traffic by 0500.									
xx	The full width of the traveled way must be open for use by traffic.									
<b>H</b>	Designated holiday									
<b>SD</b>	Special day									

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

Chart no. 1 Freeway Lane Requirements and Hours of Work																									
County: LA													Route/Direction: 5/NB												
Closure limits: South of Artesia Blvd UC to Alondra Blvd OC																									
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	2	S	N	N	N	S	S	S	S	S	S	N	N	N	N	S	3	3	3	2	
Fri	1	1	1	1	2	S	N	N	N	S	S	S	S	S	S	N	N	N	N	S	3	3	3	3	
Sat	2	1	1	1	1	2	2	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	3	
Sun	2	2	1	1	1	1	1	2	3	S	S	S	N	N	N	N	N	S	S	S	S	S	3	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
3	Provide at least 3 adjacent through freeway lanes open in direction of travel
S	Shoulder closure allowed
N	No work allowed

REMARKS: The number of through traffic lanes is 3 or 4.  
Traffic lanes outside of the through traffic lanes delineated with a double line of pavement markers as shown on "Pavement Markers and Traffic Lines Typical Details (Detail 37 series)," may be closed at the same time the adjacent ramp is allowed to be closed as shown on Chart no. 14.

**Chart no. 2  
Freeway Lane Requirements and Hours of Work**

County: LA					Route/Direction: 5/SB																				
Closure limits: Alondra Blvd OC to south of Artesia Blvd UC																									
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	2	S	N	N	N	N	N	N	N	N	N	N	N	N	N	N	S	S	S	2	
Fri	1	1	1	1	2	S	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	S	S	
Sat	2	2	2	1	1	2	2	S	N	N	N	N	N	N	N	N	N	N	N	N	S	S	S	S	
Sun	2	2	2	1	1	1	1	2	S	S	N	N	N	N	N	N	N	N	N	N	N	S	S	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
  
- |   |
|---|
| N |
|---|

 No work allowed

REMARKS: The number of through traffic lanes is 3.  
 Traffic lanes outside of the through traffic lanes delineated with a double line of pavement markers as shown on "Pavement Markers and Traffic Lines Typical Details (Detail 37 series)," may be closed at the same time the adjacent ramp is allowed to be closed as shown on Chart no. 13.

**Chart no. 3  
Freeway Lane Requirements and Hours of Work**

County: LA										Route/Direction: 5/NB															
Closure limits: South of Artesia Blvd UC to Alondra Blvd OC																									
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	2	S	N	N	N	S	3	3	3	3	3	N	N	N	N	3	3	3	3	2	
Fri	1	1	1	1	2	S	N	N	N	S	S	3	3	3	3	N	N	N	N	3	3	3	3	3	
Sat	2	1	1	1	1	2	2	3	S	S	S	S	S	S	S	S	S	S	S	S	S	3	3	3	
Sun	2	2	1	1	1	1	1	2	3	S	S	S	S	S	S	S	S	S	S	S	S	S	3	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
  - |   |
|---|
| 3 |
|---|

 Provide at least 3 adjacent through freeway lanes open in direction of travel
  - |   |
|---|
| S |
|---|

 Shoulder closure allowed
  - |   |
|---|
| N |
|---|

 No work allowed

REMARKS: The number of through traffic lanes is 4.  
 (Use this chart when freeway is widen to 4 through traffic lanes)  
 Traffic lanes outside of the through traffic lanes delineated with a double line of pavement markers as shown on "Pavement Markers and Traffic Lines Typical Details (Detail 37 series)," may be closed at the same time the adjacent ramp is allowed to be closed as shown on Chart no. 14.

**Chart no. 4  
Freeway Lane Requirements and Hours of Work**

County: LA										Route/Direction: 5/SB															
Closure limits: Alondra Blvd OC to south of Artesia Blvd UC																									
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	2	3	N	N	N	S	S	S	S	S	S	N	N	N	N	S	3	3	3	2	
Fri	1	1	1	1	2	3	N	N	N	S	S	S	S	S	S	N	N	N	N	S	S	S	3	3	
Sat	2	2	2	1	1	2	2	3	S	S	S	S	S	S	S	S	S	S	S	S	3	3	3	3	
Sun	2	2	2	1	1	1	1	2	3	3	S	S	S	S	S	S	S	S	S	S	S	3	3	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
3	Provide at least 3 adjacent through freeway lanes open in direction of travel
N	No work allowed

**REMARKS:** The number of through traffic lanes is 4.  
 (Use this chart when freeway is widen to 4 through traffic lanes)  
 Traffic lanes outside of the through traffic lanes delineated with a double line of pavement markers as shown on "Pavement Markers and Traffic Lines Typical Details (Detail 37 series)," may be closed at the same time the adjacent ramp is allowed to be closed as shown on Chart no. 13.

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

<b>Chart no. 5 Complete Freeway Closure Hours</b>																										
County: LA										Route/Direction: 5/NB																
Closure limits: Artesia Blvd Off-ramp to Valley View Ave On-ramp																										
Hour	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Mon-Thu			C	C	C																					
Fri			C	C	C																					
Sat				C	C	C																				
Sun				C	C	C	C																			

Legend:

C Freeway may be closed completely

No complete freeway closure is allowed

REMARKS: (For Striping and Loop Detector Installation)  
 Detour traffic to exit at Artesia Blvd off-ramp; north on Firestone Blvd (north of Rte 5) to the on-ramp to NB Rte 5. Place a PCMS on NB Rte 5 at the Auto Center Dr off-ramp gore area with the message: "FREEWAY / CLOSED / AHEAD - ARTESIA / TO VAL- / LEY VIEW". Post at least 5 special portable freeway detour signs, SP-2, along the detour route and remove signs at the end of each closure. Close Artesia Blvd on-ramp.

**Chart no. 6  
Complete Freeway Closure Hours**

County: LA					Route/Direction: 5/NB																				
Closure limits: Valley View Ave Off-ramp to Carmenita Rd On-ramp																									
Hour	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mon-Thu		C	C	C	C																				
Fri		C	C	C	C																				
Sat	C	C	C	C	C	C	C																		
Sun		C	C	C	C	C	C	C																	

**Legend:**

- C Freeway may be closed completely
- No complete freeway closure is allowed

**REMARKS: (For Bridge Demolition and Falsework Erection and Removal)**

Detour traffic to exit at Valley View Ave off-ramp; west on Firestone Blvd (north of Rte 5); north on Valley View Ave; west on Alondra Blvd; north on Carmenita Rd to the on-ramp to NB Rte 5. Place a PCMS on NB Rte 5 between Beach Blvd ramps with the message: "FREEWAY / CLOSED / AHEAD - VALLEY / VIEW TO / CARMNITA". Post at least 12 special portable freeway detour signs, SP-2, along the detour route and remove signs at the end of each closure.  
 Close WB Rte 91 to NB Rte 5 connector and detour traffic as shown on Chart 10.  
 Close Artesia Blvd and Valley View Ave on-ramps.

**Chart no. 7  
Complete Freeway Closure Hours**

County: LA					Route/Direction: 5/SB																				
Closure limits: Carmenita Rd Off-ramp to Artesia Blvd On-ramp																									
Hour	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mon-Thu	C	C	C	C	C																				
Fri	C	C	C	C	C																				
Sat		C	C	C	C																				
Sun		C	C	C	C	C	C																		

Legend:

C Freeway may be closed completely

No complete freeway closure is allowed

REMARKS: (For Bridge Demolition and Falsework Erection and Removal)  
 Detour traffic to exit at Carmenita Rd off-ramp; south on Carmenita Rd; east on Artesia Blvd to the on-ramp to SB Rte 5. Place two PCMS on the right shoulder of SB Rte 5, at Paramount Blvd on-ramp gore, and 2,000 feet north of Rte 605 off-connector with the message: "SOUTH 5 / CLOSD AT / CARMNITA - DETOUR / S605 / TO E91". Place a third PCMS on the right shoulder of SB Rte 5 just north of Silverbow Ave Ped OC with the message: "FREEWAY / CLOSED / AHEAD - CARMNITA / TO / ARTESIA". Post at least 11 special portable freeway detour signs, SP-2, along the detour route and remove signs at the end of each closure.  
 Close SB Rte 605 to SB Rte 5 connector and detour traffic as shown on Chart 11.  
 Close Carmenita Rd and Valley View Ave on-ramps.

Chart no. 8 Complete Freeway Closure Hours																										
County: LA										Route/Direction: 5/SB																
Closure limits: Valley View Ave Off-ramp to Artesia Blvd On-ramp																										
Hour	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Mon-Thu	C	C	C	C																						
Fri		C	C	C																						
Sat																										
Sun				C	C	C																				

Legend:

C Freeway may be closed completely

No complete freeway closure is allowed

REMARKS: (For Striping and Loop Detector Installation)  
 Detour traffic to exit at Valley View Ave off-ramp; south on Valley View Ave; east on Artesia Blvd to the on-ramp to SB Rte 5. Place a PCMS on SB Rte 5 at Shoemaker Ave OC with the message: "FREEWAY / CLOSED / AHEAD - VALLEY / VIEW TO / ARTESIA". Post at least 7 special portable freeway detour signs, SP-2, along the detour route and remove signs at the end of each closure. Close Valley View Ave on-ramp.

Chart no. 9 Complete Freeway Closure Hours																										
County: LA										Route/Direction: 5/SB																
Closure limits: Artesia Blvd Off-ramp to Artesia Blvd On-ramp																										
Hour	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Mon-Thu		C	C	C																						
Fri		C	C	C																						
Sat																										
Sun				C	C	C																				

Legend:

C Freeway may be closed completely

No complete freeway closure is allowed

REMARKS: (For Loop Detector Installation)  
 Detour traffic to exit at Artesia Blvd off-ramp; east on Artesia Blvd to the on-ramp to SB Rte 5. Place a PCMS on SB Rte 5 north of Alondra Blvd OC with the message: "FREEWAY / CLOSED - AT / ARTESIA". Post at least 3 special portable freeway detour signs, SP-2, along the detour route and remove signs at the end of each closure.

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

Chart no. 10 Complete Connector Closure Hours																									
County: ORA										Route/Direction: 91/WB															
Closure limits: WB Rte 91 to NB Rte 5																									
Hour	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mon-Thu	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C
Fri	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C
Sat	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C
Sun	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C
Legend:																									
C Connector may be closed completely																									
S Shoulder closure allowed																									
REMARKS:																									
Detour traffic to continue west on Rte 91 onto NB Rte 605 to NB Rte 5. Place a PCMS on the right shoulder of WB Rte 91 at Brookhurst Rd on-ramp gore with the message: "NORTH 5 / EXIT / CLOSED - CONTINUE / TO N605".																									

Chart no. 11 Complete Connector Closure Hours																									
County: LA										Route/Direction: 605/SB															
Closure limits: SB Rte 605 to SB Rte 5																									
Hour	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mon-Thu	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C
Fri	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C
Sat	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C
Sun	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C
Legend:																									
C Connector may be closed completely																									
S Shoulder closure allowed																									
REMARKS:																									
Detour traffic to continue south on Rte 605 onto EB Rte 91 to SB Rte 5. Place a PCMS on the right shoulder of SB Rte 605 at Telegraph Rd on-ramp gore with the message: "SOUTH 5 / EXIT / CLOSED - CONTINUE / TO E91".																									

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

Chart no. 12 Complete Ramp Closure Hours																									
County: LA										Route/Direction: 5/NB															
Closure limits: On-ramp from Artesia Blvd																									
Hour	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mon-Thu	C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Fri	C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	C
Sat	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sun	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																									
C Ramp may be closed completely																									
S Shoulder closure allowed																									
REMARKS:																									
Detour EB and WB Artesia Blvd traffic to go north on Firestone Blvd (north of Rte 5) to the on-ramp to NB Rte 5. Post at least 6 special portable freeway detour signs, SP-2, along the detour route and remove signs at the end of each closure.																									
Detour SB Firestone Blvd (north of Rte 5) traffic to go west on Artesia Blvd; north on Valley View Ave to the on-ramp to NB Rte 5. Post at least 7 special portable freeway detour signs, SP-2, along the detour route and remove signs at the end of each closure.																									
When Valley View Ave on-ramps are closed, public traffic shall be detoured to the next available on-ramp downstream of the closed ramp in the direction of travel.																									
The full width of the traveled way must be open for use by traffic when construction activities are not actively in progress.																									

Chart no. 13 Complete Ramp Closure Hours																									
County: LA										Route/Direction: 5/SB															
Closure limits: Off-ramp to Artesia Blvd																									
Hour	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mon-Thu	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C
Fri	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C
Sat	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sun	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Legend:																									
C Ramp may be closed completely																									
S Shoulder closure allowed																									
REMARKS:																									
The full width of the traveled way must be open for use by traffic when construction activities are not actively in progress.																									

Chart no. 14 Complete Ramp Closure Hours																									
County: LA										Route/Direction: 5/NB															
Closure limits: Off-ramp to Valley View Ave																									
Hour	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mon-Thu	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	
Fri	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	
Sat	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	C	C	C	C	C	
Sun	C	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	C	C	C	C	C	C	C	
Legend:																									
C Ramp may be closed completely																									
S Shoulder closure allowed																									
REMARKS:																									

Chart no. 15 Complete Ramp Closure Hours																									
County: LA										Route/Direction: 5/NB															
Closure limits: On-ramp from Valley View Ave																									
Hour	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mon-Thu	C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	
Fri	C	C	C	C	C	C	S	S	S	C	C	C	C	C	C	S	S	S	S	C	C	C	C	C	
Sat	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Sun	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Legend:																									
C Ramp may be closed completely																									
S Shoulder closure allowed																									
REMARKS:																									
<p>Detour NB and SB Valley View Ave traffic to continue south on Firestone Blvd (north of Rte 5) to the on-ramp to NB Rte 5. Post at least 4 special portable freeway detour signs, SP-2, along the detour route and remove signs at the end of each closure.</p> <p>Detour NB Firestone Blvd (north of Rte 5) traffic to go north on Valley View Ave; west on Alondra Blvd; north on Carmenita Rd to the on-ramp to NB Rte 5. Post at least 10 special portable freeway detour signs, SP-2, along the detour route and remove signs at the end of each closure.</p> <p>When Artesia Blvd or Carmenita Rd on-ramps are closed, public traffic shall be detoured to the next available on-ramp downstream of the closed ramp in the direction of travel.</p> <p>The full width of the traveled way must be open for use by traffic when construction activities are not actively in progress.</p>																									

**Chart no. 16  
Complete Ramp Closure Hours**

County: LA		Route/Direction: 5/SB																							
Closure limits: Off-ramp to Valley View Ave																									
Hour	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mon-Thu	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	
Fri	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	
Sat	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Sun	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	

Legend:

C Ramp may be closed completely

S Shoulder closure allowed

REMARKS:

The full width of the traveled way must be open for use by traffic when construction activities are not actively in progress.

**Chart no. 17  
Complete Ramp Closure Hours**

County: LA		Route/Direction: 5/SB																							
Closure limits: On-ramp from Valley View Ave																									
Hour	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mon-Thu	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	
Fri	C	C	C	C	C	C	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	
Sat	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	S	S	C	C	C	C	C	C	
Sun	C	C	C	C	C	C	C	C	C	C	C	C	S	S	S	S	S	S	C	C	C	C	C	C	

Legend:

C Ramp may be closed completely

S Shoulder closure allowed

REMARKS:

Detour traffic to go south on Firestone Blvd (south of Rte 5); east on Artesia Blvd to the on-ramp to SB Rte 5. Post at least 7 special portable freeway detour signs, SP-2, along the detour route and remove signs at the end of each closure.

**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 and moving lane closures on multilane highways and 2-lane, two-way 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**

A portable changeable message sign used in a moving lane closure must comply with section 12-3.12 except the sign must be truck mounted. The full operational height to the bottom of the sign may be less than 7 feet above the ground but must be as high as practicable.

**12-5.03 CONSTRUCTION**

**12-5.03A General**

During traffic striping and pavement marker placement using bituminous adhesive, control traffic with a stationary or a moving lane closure. During other activities, control traffic with stationary lane closures.

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.

**12-5.03B Stationary Lane Closures**

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.

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.

For multilane freeway or expressway lane closures, do not place the 2L tangent section shown along lane lines between the lane closure tapers.

**12-5.03C Moving Lane Closures**

Use a truck-mounted flashing arrow sign in a moving lane closure. Operate the flashing arrow sign in the caution display mode whenever it is being used on a 2-lane, two-way highway.

**12-5.04 PAYMENT**

A traffic control system for lane closure is paid for as traffic control system. Flagging costs are paid for as specified in section 12-1.03.

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.

AA

## 13 WATER POLLUTION CONTROL

### Add to section 13-1.01A:

The Los Angeles RWQCBs will review the authorized SWPPP.

### Add to section 13-3.01A:

The project is risk level 2.

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

Discharges of stormwater from the project must comply with the permit issued by the Los Angeles RWQCB for *National Pollutant Discharge Elimination System (NPDES) Permit CAS000002, Permit No. CAS000003*. The Los Angeles RWQCB permit governs stormwater and nonstormwater discharges resulting from construction activities in the project area. The Los Angeles RWQCB permit may be viewed at [http://www.waterboards.ca.gov/board\\_decisions/adopted\\_orders/water\\_quality/2012/wqo2012\\_0011\\_dwq.pdf](http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2012/wqo2012_0011_dwq.pdf) and [http://www.swrcb.ca.gov/water\\_issues/programs/stormwater/constpermits.shtml](http://www.swrcb.ca.gov/water_issues/programs/stormwater/constpermits.shtml)

### Replace 1st paragraph of section 13-6.03C with:

Provide temporary drainage inlet protection around drainage inlets as changing conditions require. Drainage inlet protection must be Type 1, Type 3A, Type 3B, Type 4A, Type 6A or Type 6B as appropriate for conditions around the drainage inlet.

### Replace "Reserved" in section 13-12 with:

#### 13-12 IMPERMEABLE MEMBRANE

#### 13-12.01 GENERAL

##### 13-12.01A Summary

Section 13-12 includes specifications for furnishing, placing and patching impermeable membrane.

Comply with section 88.

##### 13-12.01B Definitions

Not Used

#### 13-12.02 MATERIALS

##### 13-12.02A Impermeable Membrane

Impermeable membrane must be smooth on both sides. Impermeable membrane must consist of a single ply material. The major polymer material component of the impermeable membrane must be linear low density polyethylene (LLDPE). The impermeable membrane must be flexible enough to bend and wrap around temporary railing (type K), by its own weight, in ambient job-site air temperature, without any overburden placed on it, and without additional heating and bending.

Impermeable membrane must be manufactured from either virgin raw materials or from a combination of virgin and recycled materials. None of the materials, whether virgin or recycled, must contain biodegradable filler materials that degrade the physical or chemical characteristics of the finished roll products, such that they no longer function as leak-free water barriers. To confirm the absence of the biodegradable filter materials, the Engineer may order tests such as ASTM E 204 (Fourier Transformed Infrared Spectroscopy - FTIR) or other appropriate tests.

Impermeable membrane must be free from holes or punctures. Impermeable membrane must comply with:



**14-6.02C Construction**

**14-6.02C(1) General**

Not Used

**14-6.02C(2) Protective Radius**

Upon discovery of a regulated species, stop construction activities within a 100-foot radius of the discovery or as defined in the table below. Immediately notify the Engineer. Do not resume activities until receiving notification from the Engineer.

Regulated species name	Protective radius
Song birds	150 feet
Raptors	500 feet

**14-6.02C(3) Protocols**

Not Used

**14-6.02C(4) Biological Resource Information**

Not Used

**14-6.02C(5) Protection Measures**

Within species protection area at Bridges 53-0279, 53-C2194, 53-1363, and 53-3044, implement the following protection measures:

1. Protect bats from disturbance caused by work on, or directly beneath bridges. Bats roost inside bridges and are most active between March and October. If bats are found in an area where there will be activity, no work may start in that area until approved exclusionary measures are in place. Exclusionary measures include bat houses, netting or fabric and weep-hole covers.
2. Department Biologist will conduct weekly surveys prior to construction to determine the presence or absence of bats. The surveys may include entering bridge box girders or being lifted with your equipment to check for bats at bridge joint seals and crevices. Surveys will include monitoring bat activity, identifying types of bats present, and the need for bat exclusionary measures and bat houses. If bats are present, at least 5 working days prior to start of activities in areas where bats may be located, you must submit bat exclusionary measures and bat house requirements to the Engineer for review. The Engineer will have 10 working days to review the bat exclusionary measures and bat house requirements. If revisions are required, as determined by the Engineer, you must revise and resubmit bat exclusionary measures and bat house requirements within 5 working days of receipt of the Engineer's comments. The Engineer will have 5 working days to review the revisions. If the Engineer fails to complete the review and if, in the opinion of the Engineer, completion of work is delayed or interfered with by reason of the delay in completing the review, an extension of time will be granted in the same manner as provided in the Section 8-1.07. Upon approval of bat exclusionary measures and bat house requirements, you must implement bat exclusionary measures and bat house requirements at locations specified by the Engineer.
3. When instructed by the Engineer, you must remove and dispose of bat exclusionary measures and bat houses when no longer required as specified in Section 4-1.13 and Section 5-1.20B(4).
4. You must protect the worker health and safety as required by Section 7-1.02K(6)(a) and as required for confined space. Work practices and worker health and safety shall conform to the California Division of Occupational Safety and Health Construction Safety Orders Title 8, of the California Code of Regulations including Section 5158.

**14-6.02C(6) Monitoring Schedule**

Not Used

**14-6.02D Payment**

Not Used

**Add to section 14-8.02A:**

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

**Replace "Reserved" in section 14-8.03 with:**

**14-8.03 VIBRATION MONITORING**

**14-8.03A General**

Section 14-8.03 includes specifications relating to vibration monitoring.

Do not exceed peak particle velocity (PPV) of 0.3 inches per second at 150 ft from pile driving activities.

Furnish, install, protect from damage, maintain and replace damaged or inoperative vibration monitoring instruments. Collect vibration data and provide interpretation and reports to the Department, within 24 hours from pile driving activities.

Perform post construction condition survey of buildings and residential structures within 5 days from completion of pile driving operations. Submit finding where pile driving operation generated PPV equal or higher than 0.3 inches per second next to the structure.

**14-8.03B Submittals**

Submit the following:

1. Within 15 days before pile driving, perform preconstruction condition survey of buildings and residential structures within 150-foot radius of any pile driving activities. Preconstruction condition survey must consist of photographs of existing cracks and other architectural or structural problems or deficiencies.
2. Within 15 days before pile driving, furnish vibration monitoring plan to the Department for review and approval. Include in the vibration monitoring plan the calculation for Peak Particle Velocity (PPV) using formula:  $PPV_{\text{Hydraulic Breaker}} = PPV_{\text{Ref}} (25/D)^n \times (E_{\text{equip}}/E_{\text{Ref}})^{0.5}$  (in/sec)

Where:

$PPV_{\text{Ref}} = 0.24$  in/sec for a reference hydraulic breaker at 25 ft.

D = distance from hydraulic breaker to the receiver in ft.

n = 1.1 (the value related to the attenuation rate through ground)

$E_{\text{Ref}} = 5,000$  ft-lbs. (rated energy of reference hydraulic breaker)

$E_{\text{equip}}$  = rated energy of hydraulic breaker in ft-lbs.

3. Prepare and implement response actions.
4. Prior to pile driving, submit a written vibration monitoring plan, vibration monitoring equipment manufacturer's product data, and the resumes of the Vibration Instrumentation Engineer, as well as, any vibration monitoring technical support personnel. The vibration monitoring equipment manufacturer's data sheet must describe in detail all vibration monitoring instruments. The resumes of the Vibration Instrumentation Engineer and any vibration monitoring technical support personnel must be sufficient to define details of relevant experience. Written vibration monitoring plan must detail the procedures for vibration monitoring and recording the data. Such details must include the following:
  - a. Name of the firm providing the vibration monitoring services,
  - b. Description of the instrumentation and equipment to be used,
  - c. Measurement locations and methods for mounting the vibration sensors,
  - d. Procedures for data collection and analysis,
  - e. Sample data sheet(s) format used to record vibration,

- f. Means and methods of providing warning when the particle velocity equals or exceeds specified limits,
  - g. Generalized plan of actions to be implemented in the event the particle velocity equals or exceeds specified limits. The generalized plan of actions must be positive measures to control vibrations (e.g. using alternative construction methods),
  - h. Designate by name a "responsible person". The person designated must have authority to stop the work causing excessive vibration. Within 5 days of receipt of each instrument at the site, submit to the Engineer a copy of the instruction manual and laboratory calibration and test equipment certification. Submit data and reports as specified in "Data Reduction, Processing, Plotting, and Reporting". Preconstruction and post construction condition surveys of building and residential structures must be submitted to the Engineer within 5 days of the survey. For review period, refer to Section 48-2, "Falsework".
5. Data Reduction, Processing, Plotting and Reporting
- Within 5 working days after the completion of the background vibration monitoring, submit to the Engineer a hard copy report documenting the results at each of the monitoring locations. During bridge construction, provide weekly, hard copy reports summarizing any vibration monitoring data collected at the specified vibration monitoring locations. The reports for each week must be submitted on or before the end of the following week. Based to the volume of the data, Engineer may decide to receive the data in an electronic format. All reports must be signed by the approved Vibration Instrumentation Engineer and must include the following:
- a. Project identification, including District, County, Route, Post Mile, Project Name and Bridge numbers, as shown on the plans.
  - b. Location of the monitoring equipment.
  - c. Location of vibration sources (e.g. bent number, abutment number, pile number, etc.).
  - d. Summary tables indicating the date, time, as well as magnitude and frequency of maximum single-component PPV measured during each one-hour interval of the monitoring period.
  - e. Field data forms (construction vibration monitoring, only).
  - f. An appendix including tabulated or graphed measured data for every minute for the monitoring periods. Electronic data files for all instrument data must be provided in MS Excel format. Do not disclose any instrumentation data to third parties and do not publish data without written consent of Caltrans.

#### **14-8.03C Quality Control and Assurance**

A record of laboratory calibration must be provided for all vibration-monitoring instruments to be used on the site. Certification must be provided to indicate the instruments are calibrated and maintained in accordance with the equipment manufacturer's calibration requirements and that calibrations are traceable to the US National Institute of the Standards and Technology (NIST).

#### **14-8.03D Materials**

Provide portable vibration sensors for monitoring the velocities of ground vibrations resulting from pile driving activities. Instrumentation personnel must conduct regular maintenance of vibration sensor installations.

#### **14-8.03E Vibration Monitoring Personnel**

Vibration monitoring personnel may be on the staff of the Contractor, but must not be employed nor compensated by the subcontractor, or by persons or entities hired by subcontractor(s), who will provide other services or materials for the project. Vibration monitoring personnel must be a qualified Vibration Instrumentation Engineer, who is a registered Professional Engineer in the State of California, and has minimum of four years of experience in the installation and use of vibration monitoring instrumentation and in interpreting the measured data. Vibration Instrumentation Engineer must:

1. Be on the site and supervise the initial installation of each vibration monitoring instrument.
2. Supervise interpretation of vibration monitoring data.

Vibration monitoring personnel is subject to the Engineer's approval.

#### **14-8.03F Construction**

##### **14-8.03F(1) Vibration Monitoring and Recording**

Vibration monitoring and recording must be performed during pile driving activities at buildings and residential structures within 150-foot radius and 200-foot radius of any pile driving activities. The distance must be measured from the point of pile driving. Notify the Engineer within 48 hours prior to beginning pile driving and must have the vibration sensor in place and functioning properly prior to any work within the distances as defined. No pile driving must be conducted within the monitoring zone unless monitoring equipment is functioning properly. The equipment must be set up to provide immediate warning when PPV is equal or exceeds 0.3 inches per second. The warning emitted by the vibration monitoring equipment must be instantaneously transmitted to the responsible person by means of warning lights, audible sounds, or electronic transmission. Monitoring equipment must be stationed within 3 feet of the exterior of designated buildings and residential structures on the side facing the work site. For buildings and residential structures who frontage exceeds 150 feet, at least two monitoring must be utilized at the location. If permission to access a property is not granted, the monitoring will be conducted at the closed public access area to the structure, such as sidewalk. When any reading on monitoring equipment equals or exceeds 0.3 inches per second, immediately notify the Engineer. You must take reasonable actions to reduce and maintain the monitoring equipment reading below a particle velocity of 0.3 inches per second next to the buildings and residential structures. The vibration sensors must be firmly mounted on the surface slab or concrete or asphalt, or firmly set in undisturbed soils with a sandbag on top.

##### **14-8.03F(2) Data Collection**

Prior to pile driving activities, collect data using vibration sensors to document background vibration at each monitoring location. This monitoring must consist of a continuous recording of the maximum single-component peak particle velocity for one-minute intervals. The background monitoring must be performed for a maximum of two nonconsecutive workdays, spanning the hours during which construction activities will take place. Perform vibration monitoring during pile driving activities. The monitoring must consist of continuous recording of the maximum single-component PPV for one-minute intervals, that must be stored in the instrument and then transferred to the computer analysis. During the monitoring, document all events that are responsible for measured vibration levels and submit the documents to the Engineer with the data, as specified in "Data Reduction, Processing, Plotting and Reporting," in Section 14-8.03B, "Submittals".

##### **14-8.03G Payment**

Not Used.

#### **Add to section 14-9.02A**

Notify the Air Pollution Control District (APCD) or Air Quality Management District (AQMD) identified below as required by the National Emission Standards for Hazardous Air Pollutants (NESHAP) at 40 CFR Part 61, Subpart M, and California Health and Safety Code section 39658(b)(1). Notification must take place no less than 14 days before starting demolition or renovation activities as defined in the NESHAP regulations. Notification forms and other information are available from:

South Coast Air Quality Management District  
21865 Copley Drive  
Diamond Bar, CA 91765  
(909) 396-2000  
[www.aqmd.gov/comply/asbestos/asbestos.html](http://www.aqmd.gov/comply/asbestos/asbestos.html)

Forms and information may also be obtained from the air district's web site at: <http://www.aqmd.gov>.

Mail or otherwise deliver the original notification form with any necessary attachments to:

SCAQMD  
Asbestos Notifications  
File #55641  
Los Angeles, CA 90074-5641

Submit a copy of the notification form and attachments as an informational submittal before starting demolition or renovation activities.

**Replace section 14-11.03 with:**

**14-11.03 MATERIAL CONTAINING HAZARDOUS WASTE CONCENTRATIONS OF AERIALY DEPOSITED LEAD**

**14-11.03A General**

**14-11.03A(1) Summary**

Section 14-11.03 includes specifications for hazardous waste management while excavating, stockpiling, transporting, placing, and disposing of material containing hazardous waste concentrations of aerially deposited lead (ADL).

ADL is present within the project limits.

The Department has received from the DTSC a variance regarding the use of material containing ADL. The variance applies if Type Y-1 or Y-2 material are shown. The variance is available for inspection at the Department of Transportation, District 7, Division of Construction, 100 South Main Street, Suite 300, Los Angeles, CA 90012.

**14-11.03A(2) Definitions**

**Type Y-1:** Material that contains ADL in average concentrations (using the 90 percent Upper Confidence Limit) of 1.5 mg/L or less extractable lead (based on a modified waste extraction test using deionized water as the extractant) and 1,411 mg/kg or less total lead. This material is a California hazardous waste that may be reused as permitted under the variance of the DTSC provided that the lead contaminated soil is placed a minimum of 5 feet above the maximum historic water table elevation and covered with at least 1 foot of non-hazardous soil.

**Type Y-2:** Material that contains ADL in average concentrations (using the 90 percent Upper Confidence Limit) that exceed either 1.5 mg/L extractable lead (based on a modified waste extraction test using deionized water as the extractant) or 1,411 mg/kg total lead but are less than 150 mg/L extractable lead (based on a modified waste extraction test using deionized water as the extractant) and less than 3,397 mg/kg of total lead. This material is a California hazardous waste that may be reused as permitted under the variance of DTSC provided that the lead contaminated soil is placed a minimum of 5 feet above the maximum historic water table elevation and protected from infiltration by a pavement structure which will be maintained by the Department.

**Type Z-2:** Material that contains ADL in average concentrations (using the 95 percent Upper Confidence Limit) greater than or equal to 1,000 mg/kg total lead, greater than or equal to 5.0 mg/L soluble lead (as tested using the California Waste Extraction Test), and the material is surplus; or material that contains ADL in average concentrations greater than 150 mg/L extractable lead (based on a modified waste extraction test using deionized water as the extractant) or greater than 3,397 mg/kg total lead. This material is a Department-generated California hazardous waste and must be transported to and disposed of at a California Class I disposal site.

**Type Z-3:** Material that contains ADL in average concentrations (using the 95 percent Upper Confidence Limit) greater than 5.0 mg/L soluble lead, (as tested using the Toxicity Characteristic Leaching Procedure). This material is a Department-generated federal hazardous waste and must be transported to and disposed of at a California Class I disposal site.

**14-11.03A(3) Site Conditions**

ADL concentration data and sample locations maps are included in the *Information Handout*.

Type Y-1 material exists, as shown.

Type Y-2 material exists, as shown.

**14-11.03A(4) Submittals**

**14-11.03A(4)(a) Lead Compliance Plan**

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

Include perimeter air monitoring incorporating upwind and downwind locations as shown or as authorized. Monitor with personal air samplers using National Institute of Safety and Health Method 7082. Sampling must achieve a detection limit of 0.05 µg/ m<sup>3</sup> of air per day. Conduct daily monitoring while clearing and grubbing and performing earthwork operations. Analyze a single representative daily sample for lead. Analyze the sample and provide results to the Engineer within 24 hours. Analyses must be performed by a laboratory accredited by the Environmental Lead Laboratory-Accreditation Program of the American Industrial Hygiene Association. Average lead concentrations must not exceed 1.5 µg/ m<sup>3</sup> of air per day and 0.15 µg/ m<sup>3</sup> per day on a rolling 90-day basis. Calculate average daily concentrations based on monitoring to date, and projection based on those monitoring trends for the next 90 days or to the end of work subject to the lead compliance plan if less than the specified averaging period. If concentrations exceed these levels stop work and modify the work to prevent release of lead. Monitor under the direction of a CIH. The air monitoring data must be reviewed by and signed by the CIH.

#### **14-11.03A(4)(b) Excavation and Transportation Plan**

Within 15 days after approval of the Contract, submit 3 copies of an excavation and transportation plan. Allow 10 days for review. If revisions are required, as determined by the Engineer, submit the revised plan within 7 days of receipt of the Engineer's comments. For the revision, allow 7 days for the review. Minor changes to or clarifications of the initial submittal may be made and attached as amendments to the excavation and transportation plan. In order to allow construction to proceed, the Engineer may conditionally approve the plan while minor revisions or amendments are being completed.

Prepare the written, project specific excavation and transportation plan establishing the procedures you will use to comply with requirements for excavating, stockpiling, transporting, and placing or disposing of material containing ADL. The plan must comply with the regulations of the DTSC and Cal/OSHA and the requirements of the variance. The sampling and analysis portions of the excavation and transportation plan must meet the requirements for the design and development of the sampling plan, statistical analysis, and reporting of test results contained in US EPA, SW 846, "Test Methods for Evaluating Solid Waste," Volume II: Field Manual Physical/Chemical, Chapter Nine, Section 9.1. The plan must include the following elements:

1. Excavation schedule by location and date
2. Temporary locations of stockpiled material
3. Sampling and analysis plans for areas after removal of a stockpile. Include the following:
  - 3.1. Location and number of samples
  - 3.2. Name and address of the CDPH Environmental Laboratory Accreditation Program (ELAP) certified laboratory where the analysis was performed
4. Survey methods for Type Y-1 or Y-2 material burial locations
5. Sampling and analysis plan for soil cover
6. Dust control measures
7. Air monitoring. Include the following information:
  - 7.1. Location and type of equipment
  - 7.2. Sampling frequency
  - 7.3. Name and address of the accredited laboratory where the analysis was performed
8. Transportation equipment and routes
9. Method for preventing spills and tracking material onto public roads
10. Truck waiting and staging areas
11. Example of bill of lading to be carried by trucks transporting Type Y-1 or Y-2, material. The bill of lading must include:
  - 11.1. US Department of Transportation (US DOT) description including shipping name
  - 11.2. Hazard class
  - 11.3. Identification number
  - 11.4. Handling codes
  - 11.5. Quantity of material
  - 11.6. Volume of material
12. Spill Contingency Plan for material containing ADL

#### **14-11.03A(4)(c) Burial Location Report**

Within 5 business days of completing placement of Type Y-1 or Y-2 material at a burial location, submit a report for that burial location, including "Burial Location of Soil Containing Aerial Deposited Lead" form

and electronic geospatial vector data shapefiles of the top and bottom perimeters of the burial location. Submit to the Engineer and to:

ADL@dot.ca.gov

The Engineer notifies you of acceptance or rejection of the burial location report within 5 business days of receipt. If the report is rejected, you have 5 business days to submit a corrected report.

**14-11.03A(4)(d) Bill of Lading**

Copies of the bills of lading must be submitted as an informational submittal upon placement of Type Y-1 or Y-2 material in its final location.

**14-11.03A(5) Quality Control and Assurance**

Excavation, reuse, and disposal of material with ADL must comply with rules and regulations of the following agencies:

1. US DOT
2. US EPA
3. California Environmental Protection Agency
4. CDPH
5. DTSC
6. Cal/OSHA
7. California Department of Resources Recycling and Recovery
8. RWQCB, Region 4, Los Angeles
9. California Air Resources Board
10. South Coast Air Quality Management District

Transport and dispose of material containing hazardous levels of lead under federal and state laws and regulations and county and municipal ordinances and regulations. Laws and regulations that govern this work include:

1. Health & Safety Code, Division 20, Chp 6.5 (California Hazardous Waste Control Act)
2. 22 CA Code of Regs, Div. 4.5 (Environmental Health Standards for the Management of Hazardous Waste)
3. 8 CA Code of Regs

**14-11.03B Materials**

Not Used

**14-11.03C Construction**

**14-11.03C(1) General**

Not Used

**14-11.03C(2) Material Management**

Place Type Y-1 material as shown and cover with a minimum 1-foot layer of nonhazardous soil or the pavement structure. Temporary surplus material may be generated on this project due to the requirements of stage construction. Do not transport temporary surplus outside the job site. It may be necessary to:

1. Stockpile material for subsequent stages.
2. Construct some embankments out of stage.
3. Handle temporary surplus material more than once.

Place Type Y-2 material as shown and cover with the pavement structure. Temporary surplus material may be generated on this project due to the requirements of stage construction. Do not transport temporary surplus material outside the job site. It may be necessary to:

1. Stockpile material for subsequent stages.
2. Construct some embankments out of stage.
3. Handle temporary surplus material more than once.

#### **14-11.03C(3) Dust Control**

Excavation, transportation, placement, and handling of material containing ADL must result in no visible dust migration. A water truck or tank must be on the job site at all times while clearing and grubbing or performing earthwork operations in work areas containing ADL. Apply water to prevent visible dust.

#### **14-11.03C(4) Surveying Type Y-1 or Y-2 Material Burial Locations**

Survey the location of the bottom and top perimeters of each area where you bury Type Y-1 or Y-2 material (burial locations). The survey must be performed by or under the direction of one of the following:

1. Land surveyor licensed under the Bus & Prof Code, Chp 15 (commencing with § 8700)
2. Civil engineer licensed prior to January 1, 1982 under the Bus & Prof Code, Chp 7 (commencing with § 6700)

Survey 10 points to determine each burial location horizontally and vertically within the specified accuracies and to create closed polygons of the perimeters of the bottom and top of the burial location. If 10 points are not sufficient to define the polygon, add additional points until the polygon is defined. Establish the position of the bottom and top perimeters before placing subsequent layers of material that obstruct the location.

Report each burial location in California State Plane Coordinates in US Survey feet within the appropriate zone of the California Coordinate System of 1983 (CCS83) and in latitude and longitude. Horizontal positions must be referenced to CCS83 (epoch 2007.00 or later National Geodetic Survey [NGS] or California Spatial Reference Center [CSRC] published epoch) to an accuracy of 3 ft horizontally. The elevation of points identifying the burial location must locate the bottom and top of Type Y-1 or Y-2 material to an accuracy of 1 ft vertically. Elevations of the bottom and top of Type Y-1 or Y-2 material must be referenced to North American Vertical Datum of 1988 (NAVD88). Report accuracy of spatial data in US Survey feet under Federal Geographic Data Committee (FGDC)-STD-007.1-1998.

#### **14-11.03C(5) Material Transportation**

Before traveling on public roads, remove loose and extraneous material from surfaces outside the cargo areas of the transporting vehicles and cover the cargo with tarpaulins or other cover, as outlined in the approved excavation and transportation plan. You are responsible for costs due to spillage of material containing lead during transport. Transportation routes for Type Y-1 or Y-2 material must only include the highway.

#### **14-11.03C(6) Disposal**

Analyze surplus material for which the lead content is not known for lead before removing the material from within the project limits. Submit a sampling and analysis plan and the name of the analytical laboratory at least 15 days before beginning sampling and analysis. Use a CDPH ELAP certified laboratory. Sample at a minimum rate of 1 sample for each 200 cu yd of surplus material and test for lead using US EPA Method 6010B or 7000 series.

Not Used

#### **14-11.03D Payment**

Payment for a lead compliance plan is not included in the payment for environmental stewardship work.

The Department does not pay for stockpiling of material containing ADL, unless the stockpiling is ordered. The Department does not pay for sampling and analysis unless it is ordered. The Department does not pay for additional sampling and analysis required by the receiving landfill.

Sampling, analyses, and reporting of results for surplus material not previously sampled is change order work.

**Replace section 14-11.07 with:**

**14-11.07 REMOVE YELLOW TRAFFIC STRIPE AND PAVEMENT MARKING WITH HAZARDOUS WASTE RESIDUE**

**14-11.07A General**

**14-11.07A(1) Summary**

Section 14-11.07 includes specifications for removing existing yellow thermoplastic and yellow painted traffic stripe and pavement marking. The residue from the removal of this material is a Department-generated hazardous waste.

Residue from removal of yellow thermoplastic and yellow painted traffic stripe and pavement marking contains lead chromate. The average lead concentration is at least 1,000 mg/kg total lead or 5 mg/l soluble lead. When applied to the roadway, the yellow thermoplastic and yellow painted traffic stripe and pavement marking contained as much as 2.6 percent lead. Residue produced from the removal of this yellow thermoplastic and yellow painted traffic stripe and pavement marking contains heavy metals in concentrations that exceed thresholds established by the Health & Safety Code and 22 CA Code of Regs. For bidding purposes, assume the residue is not regulated under the Federal Resource Conservation and Recovery Act (RCRA), 42 USC § 6901 et seq.

Work associated with disposal of hazardous waste residue regulated under RCRA as determined by test results is change order work.

Yellow thermoplastic and yellow paint may produce toxic fumes when heated.

**14-11.07A(2) Submittals**

**14-11.07A(2)(a) General**

Reserved

**14-11.07A(2)(b) Lead Compliance Plan**

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

**14-11.07A(2)(c) Work Plan**

Submit a work plan for the removal, containment, storage, and disposal of yellow thermoplastic and yellow painted traffic stripe and pavement marking. The work plan must include:

1. Objective of the operation
2. Removal equipment
3. Procedures for removal and collection of yellow thermoplastic and yellow painted traffic stripe and pavement marking residue, including dust
4. Type of hazardous waste storage containers
5. Container storage location and how it will be secured
6. Hazardous waste sampling protocol and QA/QC requirements and procedures
7. Qualifications of sampling personnel
8. Analytical lab that will perform the analyses
9. DTSC registration certificate and CA Highway Patrol (CHP) Biennial Inspection of Terminals (BIT) Program compliance documentation of the hazardous waste hauler that will transport the hazardous waste
10. Disposal site that will accept the hazardous waste residue

The Engineer will review the work plan within 5 business days of receipt.

Do not perform work that generates hazardous waste residue until the work plan has been authorized.

Correct any rejected work plan and resubmit a corrected work plan within 5 business days of notification by the Engineer. A new review period of 5 business days will begin from date of resubmittal.

**14-11.07A(2)(d) Analytical Test Results**

Submit analytical test results of the residue from removal of yellow thermoplastic and yellow painted traffic stripe and pavement marking, including chain of custody documentation, for review and acceptance before:

1. Requesting the Engineer's signature on the waste profile requested by the disposal facility
2. Requesting the Engineer obtain an US EPA Generator Identification Number for disposal
3. Removing the residue from the site

#### **14-11.07A(2)(e) U.S. Environmental Protection Agency Identification Number Request**

Submit a request for the US EPA Generator Identification Number when the Engineer accepts analytical test results documenting that residue from removal of yellow thermoplastic and yellow painted traffic stripe and pavement marking is a hazardous waste.

#### **14-11.07A(2)(f) Disposal Documentation**

Submit documentation of proper disposal from the receiving landfill within 5 business days of residue transport from the project.

#### **14-11.07B Materials**

Not Used

#### **14-11.07C Construction**

Where grinding or other authorized methods are used to remove yellow thermoplastic and yellow painted traffic stripe and pavement marking that will produce a hazardous waste residue, immediately contain and collect the removed residue, including dust. Use a HEPA filter-equipped vacuum attachment operated concurrently with the removal operations or other equally effective approved methods for collection of the residue.

Make necessary arrangements to test the yellow thermoplastic and yellow paint hazardous waste residue as required by the disposal facility and these special provisions. Testing must include:

1. Total lead by US EPA Method 6010B
2. Total chromium by US EPA Method 6010B
3. Soluble lead by California Waste Extraction Test (CA WET)
4. Soluble chromium by CA WET
5. Soluble lead by Toxicity Characteristic Leaching Procedure (TCLP)
6. Soluble chromium by TCLP

From the first 220 gal of hazardous waste or portion thereof if less than 220 gal of hazardous waste are produced, a minimum of 4 randomly selected samples must be taken and analyzed individually. Samples must not be composited. From each additional 880 gal of hazardous waste or portion thereof if less than 880 gal are produced, a minimum of 1 additional random sample must be taken and analyzed. Use chain of custody procedures consistent with chapter 9 of US EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846) while transporting samples from the project to the laboratory. Each sample must be homogenized before analysis by the laboratory performing the analyses. A sample aliquot sufficient to cover the amount necessary for the total and the soluble analyses must then be taken. This aliquot must be homogenized a 2nd time and the total and soluble analyses run on this aliquot. The homogenization process must not include grinding of the samples. Submit the name and location of the disposal facility that will be accepting the hazardous waste and the analytical laboratory along with the testing requirements not less than 5 business days before the start of removal of yellow thermoplastic and yellow painted traffic stripe and pavement marking. The analytical laboratory must be certified by the California Department of Public Health (CDPH) Environmental Laboratory Accreditation Program (ELAP) for all analyses to be performed.

After the Engineer accepts the analytical test results, dispose of yellow thermoplastic and yellow paint hazardous waste residue at a Class 1 disposal facility located in California under the requirements of the disposal facility operator within 30 days after accumulating 220 pounds of residue and dust.

If less than 220 pounds of hazardous waste residue and dust is generated in total, dispose of it within 30 days after the start of accumulation of the residue and dust.

The Engineer will sign all manifests as the generator within 2 business days of receiving and accepting the analytical test results and receiving your request for the US EPA Generator Identification Number. Use a transporter with a current DTSC registration certificate and that is in compliance with the CHP BIT Program when transporting hazardous waste.

#### **14-11.07D Payment**

Payment for a lead compliance plan is not included in the payment for environmental stewardship work.

If analytical test results demonstrate that the residue is a non-hazardous waste and the Engineer agrees, dispose of the residue at an appropriately permitted CA Class II or CA Class III facility. The Department does not adjust payment for this disposal.

**Replace "Reserved" in section 14-11.08 with:**

#### **14-11.08A General**

Section 14-11.08 includes specifications relating to the disturbance of existing paint systems.

The existing paint system on bridge number 53-0631 (R & L) contains lead and chromium. Any work that disturbs the existing paint system exposes workers to health hazards and produces:

1. Debris containing heavy metal in amounts that exceed the thresholds established in 8 CA Code of Regs and 22 CA Code of Regs. This debris is a Department-generated hazardous waste.
2. Toxic fumes when heated.

Grime and detritus already on the bridge before the start of work may also contain lead. Consider this grime and detritus part of the existing paint system. The Department is the hazardous waste generator if the Engineer accepts waste-characterization test results demonstrating that the debris is a hazardous waste.

Contain all debris produced when the existing paint system is disturbed. If containment measures are inadequate to contain and collect debris produced when the existing paint system is disturbed, stop the work and do not perform additional work until:

1. Revised debris containment and collection plan has been authorized
2. Released material has been collected and contained

Handle, store, transport, and dispose of debris produced when the existing paint system is disturbed under applicable federal, state, and local hazardous waste laws.

#### **14-11.08B Submittals**

##### **14-11.08B(1) General**

Not Used

##### **14-11.08B(2) Debris Containment and Collection Plan**

Submit a debris containment and collection plan. The plan must:

1. Identify materials, equipment, and methods to be used when the existing paint system is disturbed
2. Include shop drawings of:
  - 2.1. Containment systems complying with section 59-2.03B(3)
  - 2.2. Components that provide ventilation, air movement, and visibility for worker safety
3. Include the name and location of the analytical laboratory that will perform the analyses
4. Identify the hazardous waste transporter that will haul the debris and provide documentation of
  - 4.1 Current DTSC registration
  - 4.2 Compliance with the CA Highway Patrol Biennial Inspection of Terminals Program
5. Include the name and location of the disposal facility that will accept the hazardous waste

Allow 20 days for review.

If required, submit a revised debris containment and collection plan.

##### **14-11.08B(3) Lead Compliance Plan**

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

##### **14-11.08B(4) Air Monitoring Reports**

Air monitoring reports, including test results for samples taken after corrective action, must be prepared by the CIH and submitted:

1. Verbally within 48 hours after sampling
2. As an informational submittal within 5 days after sampling

Air monitoring reports must include:

1. Date and location of sample collection, sample number, contract number, bridge number, full name of the structure, and District-County-Route-Post mile
2. Name and address of the certified laboratory that performed the analyses
3. Chain of custody documentation
4. List of emission control measures in place when air samples were taken
5. Air sample results compared to the appropriate permissible exposure limit (PEL)
6. Corrective action recommended by the CIH to ensure exposure to airborne metals outside containment systems and work areas is within specified limits
7. Signature of the CIH who reviewed the data and made recommendations

Not Used

#### **14-11.08B(5) Soil Sampling Results for Debris Containment Verification**

Submit test results of soil analysis verifying debris containment, including results for soil samples taken after corrective action:

1. Verbally within 48 hours after sampling
2. Within 5 days after sampling

Soil sampling results must include:

1. Date and location of sample collection, sample number, contract number, bridge number, full name of the structure and District-County-Route-Post mile
2. Concentrations of heavy metals expressed in mg/kg and mg/L
3. Name and address of the certified laboratory that performed the analyses
4. Chain of custody documentation

#### **14-11.08B(6) Waste-Characterization Test Results**

Submit waste-characterization test results for the debris and chain of custody documentation before:

1. Requesting the Engineer's signature on the disposal facility's waste profile document
2. Requesting a generator's EPA Identification Number
3. Removing the debris from the site

#### **14-11.08B(7) Request for U.S. Environmental Protection Agency Identification Number**

Submit a request for the generator's EPA Identification Number when the Engineer accepts waste-characterization test results documenting that the debris is a hazardous waste.

#### **14-11.08B(8) Disposal Documentation**

Submit documentation from the receiving landfill or recycling facility confirming proper disposal within 5 business days of transporting debris from the project.

#### **14-11.08C Safety and Health Provisions**

##### **14-11.08C(1) General**

Comply with 8 CA Code of Regs, including § 1532.1.

##### **14-11.08C(2) Protective Work Clothing and Washing Facilities**

Supply clean protective work clothing for 5 Department personnel:

1. Whenever there is possible exposure to heavy metals or silica dust
2. During application of paint undercoats

Replace protective work clothing as needed.

Protective work clothing and washing facilities must be inspected and authorized for use by Department personnel before starting any activity with the potential for lead exposure.

Protective work clothing remains your property upon completion of the Contract.

#### **14-11.08D Work Area Monitoring**

##### **14-11.08D(1) General**

Monitor the ambient air and soil in and around the work area to verify the effectiveness of the containment system. Work area monitoring includes:

1. Collecting, analyzing, and reporting air and soil test results
2. Recommending corrective action when specified air or soil concentrations are exceeded

Collect air and soil samples at locations designated by the Engineer.

##### **14-11.08D(2) Air Monitoring**

Air monitoring must be performed under the direction of a CIH.

Collect and analyze air samples to detect lead under the National Institute of Occupational Safety and Health (NIOSH) Method 7082 using a detection limit of at least  $0.05 \mu\text{g}/\text{m}^3$ . Collect and analyze air samples to detect other metals under NIOSH Method 7300 using a detection limit of at least 1 percent of the appropriate PEL specified by Cal/OSHA. You may use alternative methods of sampling and analysis with equivalent detection limits.

Concentrations of airborne metals outside containment systems and work areas must not exceed any of the following:

1. Average of  $1.5 \mu\text{g}/\text{m}^3$  of air per day and  $0.15 \mu\text{g}/\text{m}^3$  per day on a rolling 90-day basis. Calculate average daily concentrations based on monitoring to date and projections based on monitoring trends for the next 90 days or to the end of work subject to the lead compliance plan if less than the specified averaging period.
2. 10 percent of the action level specified for lead by 8 CA Code of Regs §1532.1.
3. 10 percent of the appropriate PELs specified for other metals by Cal/OSHA.

Collect air samples daily during work activities that disturb the existing paint system. Air samples must be analyzed within 48 hours by a facility accredited by the Environmental Lead Laboratory Accreditation Program of the American Industrial Hygiene Association. If concentrations of airborne metals exceed allowable levels, modify the containment system or work activities to prevent further release of metals. If the CIH recommends corrective action, collect and analyze additional samples after implementing the corrective action unless directed otherwise.

##### **14-11.08D(3) Soil Sampling for Debris Containment**

Collect 25 soil samples before starting work and collect 25 soil samples within 36 hours after cleaning existing steel. A soil sample consists of 5 plugs, each 3/4 inch in diameter and 1/2 inch deep, taken at each corner and center of a 1 sq yd area. Analyze soil samples for:

1. Total lead and chromium by US EPA Method 6010B or US EPA Method 7000 Series
2. Soluble lead and chromium by California Waste Extraction Test (CA WET)

The laboratory that analyzes the samples must be certified by the State Water Resources Control Board (SWRCB) Environmental Laboratory Accreditation Program (ELAP) for all analyses to be performed.

Concentrations of heavy metals in the work area soil must not increase when the existing paint system is disturbed. If soil sampling shows an increase in the concentrations of heavy metals after completing the work:

1. Clean the affected area
2. Resample until soil sampling and testing shows concentrations of heavy metals less than or equal to the concentrations collected before the start of work

In areas without exposed soil, the concentrations of heavy metals in the work area must not increase when the existing paint system is disturbed. Any visible increase in the concentrations of heavy metals must be removed.

#### **14-11.08E Debris Management**

##### **14-11.08E(1) Debris Storage**

Debris produced when the existing paint system is disturbed must not be temporarily stored on the ground. Before the end of each work shift, remove accumulated debris from the containment system. Store the debris as a hazardous waste.

##### **14-11.08E(2) Debris Waste Characterization**

Perform waste characterization testing on the debris as required by the disposal facility including:

1. Total lead and chromium by US EPA Method 6010B
2. Soluble lead and chromium by California Waste Extraction Test (CA WET)
3. Soluble lead and chromium by Toxicity Characteristic Leaching Procedure (TCLP)

From the first 220 gal of hazardous waste or portion thereof, if less than 220 gal of hazardous waste are produced, a minimum of 4 randomly selected samples must be taken and analyzed individually. Samples must not be composited. From each additional 880 gal of hazardous waste or portion thereof, if less than 880 gal are produced, a minimum of 1 additional random sample must be taken and analyzed.

Use chain of custody procedures consistent with chapter 9 of US EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846) while transporting samples from the job site to the analytical laboratory. The laboratory must be certified by the State Water Resources Control Board (SWRCB) Environmental Laboratory Accreditation Program (ELAP) for all analyses to be performed.

Before performing the analyses, the laboratory must homogenize each sample. The homogenization process must not include grinding of the samples. A sample aliquot must be:

1. Obtained in an amount large enough for all analyses to be performed
2. Homogenized a 2nd time
3. Used for the total and soluble analyses after the 2nd homogenization

##### **14-11.08E(3) Debris Transport and Disposal**

###### **14-11.08E(3)(a) General**

For bidding purposes, assume the debris is a hazardous waste.

###### **14-11.08E(3)(b) Hazardous Waste Debris**

After the Engineer accepts the waste-characterization test results, dispose of the debris:

1. Within 30 days after accumulating 220 lb of debris
2. At an appropriately permitted Class I facility located in California

Make all arrangements with the operator of the disposal facility.

If less than 220 lb of hazardous waste is generated in total, dispose of it within 30 days after the start of accumulation of the debris.

Use a hazardous waste manifest and a transporter using vehicles with current DTSC registration certificate when transporting hazardous waste. The Engineer provides the generator's EPA Identification Number and signs all manifests as the hazardous waste generator within 2 business days of accepting the waste-characterization test results and receiving your request for the generator's EPA Identification Number.

###### **14-11.08E(3)(c) Nonhazardous Waste Debris**

If waste characterization test results demonstrate that the debris is a nonhazardous waste and the Engineer accepts the results, dispose of the debris at an appropriately permitted CA Class II or CA Class III facility or recycle it. Make all arrangements with the operator of the disposal facility and comply with the facility's requirements.

You may dispose of nonhazardous debris at a facility equipped to recycle the debris if:

1. Copper slag abrasive blended by the supplier with a calcium silicate compound is used for blast cleaning.
2. You make all arrangements with the recycling facility's operator and perform any facility-required testing of the debris.

The Department does not adjust payment for disposal of nonhazardous debris at a recycling facility.

**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 guardrails and roadside signs are 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 section 14-11.11 with:**

### **14-11.11 HANDLING OF MATERIALS AND LIQUIDS CONTAMINATED WITH POTENTIALLY HAZARDOUS SUBSTANCES AND PETROLEUM HYDROCARBONS**

#### **14-11.11A GENERAL**

##### **14-11.11A(1) Summary**

Excavation, decontamination, soil stockpiling, water storage, sample collection, transportation, contaminated material and contaminated liquid disposal, and reporting must comply with the laws, regulations, rules and ordinances of:

1. United States Department of Transportation (USDOT)
2. United States Environmental Protection Agency (USEPA)
3. California Environmental Protection Agency (Cal-EPA)
4. California Department of Toxic Substances Control (DTSC), Southern Region 3
5. California Department of Public Health
6. California Integrated Waste Management Board
7. Regional Water Quality Control Board (RWQCB), Region 4, Los Angeles
8. California Air Resources Board
9. South Coast Air Quality Management District (SCAQMD)
10. California Division of Occupational Safety and Health Administration (Cal-OSHA)
11. Los Angeles County
12. Local municipalities

Reports, plans, tasks and activities must comply with the laws and regulations for handling contaminated material and contaminated liquid, provided in:

1. Health and Safety Code, Division 20, Chapter 6.5 (California Hazardous Waste Control Act)
2. Title 22, California Code of Regulations, Division 4.5 (Environmental Health Standards for the Management of Hazardous Waste)
3. Title 8, California Code of Regulations
4. Rule 1166 - Volatile Organic Compound Emissions from Decontamination of Soil and Rule 403 - Fugitive Dust, South Coast Air Quality Management District
5. California Human Health Screening Levels (CHHSLs)
6. USEPA Region 9 Remediation Screening Levels (RSLs)
7. USEPA Maximum Contaminant Levels (MCLs)
8. DTSC Determination of a Southern California Regional Background Arsenic Concentration in Soil

You must comply with environmental rules, regulations, screening levels to protect workers, avoid spreading contamination across the job site, and not contaminate drinking water aquifers.

Job site work includes handling contaminated materials at the contaminated industrial properties in the information handouts and handling contaminated liquid anywhere on the job site. Contaminated materials and contaminated liquids are potentially hazardous to human health and the environment. Limited site investigations (SIs) were done at suspect industrial properties within the job site. The purpose of each SI was to find out if hazardous substances and petroleum hydrocarbons have contaminated the soil, soil vapor, and perched groundwater. SIs were also used to see if the concentrations of any hazardous substances and petroleum hydrocarbons are potentially harmful to human health and the environment. From the SI results, any contaminated materials and contaminated liquids with compound concentrations above the regulatory standards or screening levels were considered potentially hazardous requiring remediation.

Contaminated materials and contaminated liquids must be removed, stockpiled, and containerized in the designated staging areas for waste profiling. Remediation of contaminated materials will consist of excavating, stockpiling, sampling, and disposal. Remediation of contaminated liquid will consist of extracting, containerizing, sampling, and disposal. Based on the analytical laboratory results, it may be necessary to transport the contaminated materials and contaminated liquids to a disposal facility.

You are responsible for protecting workers from exposure to soil gas at the job site. Refer to the Information Handout attachment for sites with detection of volatile organic compounds in soil gas.

Contaminated materials exist at:

1. Dunkel Brothers, Parcel no. 79850, 14500 Firestone Boulevard, La Mirada, CA
2. Hayes Wheel, Parcel no. 77605, 14508 Firestone Boulevard, La Mirada, CA
3. BDT La Mirada Property LLC, Parcel no. 79852, Vista Media, 14440 Firestone Boulevard, La Mirada, CA
4. Star Scrap Metal/Starow Metal Recycling, Parcel nos. 79887 and 77047, 14334 Firestone Boulevard, 14370 Firestone Boulevard, and 14372 Firestone Boulevard, La Mirada, CA
5. Lens Technology, LLC, Parcel no. 79869, 14256 Firestone Boulevard, La Mirada, CA
6. Texaco Service Station, Parcel no. 77793, 14220 Firestone Boulevard, La Mirada, CA

7. Chevron Service Station, Parcel no. 77794, 14240 Firestone Boulevard, La Mirada, CA
8. Perlin Trust, Parcel no. 77792, 14210 Firestone Boulevard, La Mirada, CA
9. Komatsu Forklifts, Parcel no. 77612, 14131 Freeway Drive, Santa Fe Springs, CA
10. Eagle Properties, LLC, Parcel no. 79832, 14849 Firestone Boulevard, La Mirada, CA
11. Leaf Spring Supply, Parcel no. 79833, 14815 Firestone Boulevard, La Mirada, CA
12. APR III LLC, Parcel No. 77604, 14670 Firestone Boulevard, LaMirada, CA
13. City, County, and State Right of Ways

Groundwater at the job site is considered contaminated liquid and must be containerized and placed in staging areas segregated by parcel.

Site investigation reports will be available as an *Information Handout* as specified in section 2-1.06B.

#### **14-11.11A(2) Definitions**

**Construction and Investigative Derived Materials:** Construction and investigative derived waste is defined by the USEPA definition of investigative derived waste (IDW) and include drilling mud, soil cuttings, purged water, contaminated personal protective equipment (PPE), and solutions to decontaminate reusable equipment.

**Contaminated Liquids:** Contaminated liquids include contaminated groundwater, petroleum free product, and all other chemical free product. Groundwater beneath the job site is contaminated from industrial properties and regional groundwater. Extracted groundwater is contaminated liquid. Containerize contaminated groundwater and segregate by parcel.

**Contaminated Materials:** Contaminated materials include soil from roadway, structure, sewer and storm drain excavation, soil saturated with water or free product, and all other solids.

#### **14-11.11A(3) Hazardous Materials Mitigation Plans**

Hazardous materials mitigation plans include:

1. Soil and Water Staging Area Plan (SWSA)
2. Excavation Plan (EP)
3. Health and Safety Plan (HASP)
4. Sampling and Analysis Plan (SAP)
5. Soil and Water Sampling Report (SWSR)
6. Transportation and Disposal Plan (TDP)

#### **14-11.11A(4) Submittals**

Submit plans or reports within the allowed time:

1. SWSA within 15 days of contract approval
2. EP within 15 days of contract approval
3. HASP within 15 days of contract approval and before starting any job site work
4. SAAP within 30 days of contract approval and before starting job site work
5. SWSR within 15 days of completing a sampling event
6. TDP within 15 days before starting any job site work

Allow:

1. 15 days for SWSA review
2. 15 days for EP review
3. 15 days for HASP
4. 15 days for SAAP review
5. 20 days for SWSR review
6. 15 days for TDP review

If revisions are required, you must revise and resubmit:

1. SWSA within 10 days of receipt of comments
2. EP within 10 days of receipt of comments

3. SAAP within 10 days of receipt of comments
4. SWSR within 15 days of receipt of comments
5. TDP within 10 days of receipt of comments

Allow time for review of revisions, including:

1. 10 days for SWSA
2. 10 days for EP
3. 10 days for SAAP
4. 15 days for SWSR
5. 10 days for TDP

If the Engineer fails to review your submittals within the allowed time and if work is delayed or interfered with because of the delay, compensation will comply with section 8-1.07. Review time is in working days only and does not include weekends and holidays.

If reports are unacceptable, this is not an excusable delay and you will not be compensated.

Do not submit more than 2 hazardous materials mitigation plans every 5 days. Additional submittals will be rejected. You must obtain approvals for the first or current repeatable delivery before submitting a subsequent delivery.

Submit:

1. One hard copy and one electronic copy of Monthly Progress reports
2. Four hard copies and one electronic copy of SWSA
3. Four hard copies and one electronic copy of EP
4. Four hard copies and one electronic copy of HASP
5. Four hard copies and one electronic copy of SAP
6. Three hard copies and one electronic copy of SWSR
7. Two hard copies and one electronic copy of TDP

#### **14-11.11A(4)(a) Soil and Water Staging Area Plan**

Submit a SWSA within 15 days of contract approval. The SWSA must be accepted before handling contaminated materials or contaminated liquids. The final SWSA must be signed by the contractor's project manager supervising the preparation of the plan. The SWSA must identify fenced, temporary storage staging areas (staging areas) for contaminated materials and contaminated liquids that are on the job site and accessible to all excavation areas without leaving the job site. Do not locate staging areas upslope from or allow entrance into storm drains, inlets, or waters of the State and do not place them where they may contact surface water.

Staging areas must have a truck decontamination area including a tire wash.

#### **14-11.11A(4)(b) Excavation Plan**

Submit an EP within 15 days of contract approval. The EP must be accepted before handling any contaminated material or contaminated water, including excavation, sampling, and transport off-site for disposal. The final EP must be signed by the contractor's project manager supervising the preparation of the plan and submitted for review and approval within 5 days after receipt of comments.

Contaminated material excavation and contaminated liquid containment must comply with the accepted SWSA.

Contaminated areas extend through multiple parcels.

The EP must include:

1. Procedures for excavation and segregation of contaminated material, contaminated liquid, and IDW by property and decontamination process.
2. Contaminated area excavation plan
3. Volume estimate for each contaminated area

4. Staging areas and methods to secure and prevent access
5. Excavation, stockpiling, and containerization procedures
6. Types of containers
7. Staging area inspection process and schedule
8. Decontamination process
9. Transportation routes from contaminated areas to staging areas

#### **14-11.11A(4)(c) Health and Safety Plan**

Submit a HASP within 15 days of contract approval, and before starting any job site work. A task specific HASP must be signed by an industrial hygienist registered as a Certified Industrial Hygienist (CIH) in the State.

The HASP must protect workers from hazards, under Cal-OSHA regulations and 29 CFR 1910.120, and include safety procedures for site personnel (including State personnel) and subcontractors, to prevent or minimize worker exposure to chemical, physical, biological, and environmental hazards while handling contaminated material and contaminated liquids.

Conduct initial and daily pre-entry safety meetings.

The HASP must:

1. Identify key site safety personnel and their roles, including 40 hour health and safety training before starting work at the job site and 8 hour annual refresher training records. The level of training must conform to Cal-OSHA regulations and be consistent with the personnel's job function, the proposed work, and potential hazards. You must provide to State personnel, all health and safety training programs, personal protective equipment, and medical surveillance required by your HASP for personnel working within exclusion zones. The number of State personnel requiring the Health and Safety training program, PPE, and medical surveillance is 7.
2. Describe activities and risks associated with exposure to hazardous waste and substances, including soil gas.
3. Define training, including safe work practices, and administrative and engineering controls.
4. Include hand and eye wash facilities and appropriate PPE and conditions under which upgrade of PPE will be required.
5. Include medical surveillance requirements.
6. Include perimeter air monitoring for airborne hazardous substances and total petroleum hydrocarbons (TPH) identified on the job site, including volatile organic compounds (VOCs) and particulate matter, during handling of Contaminated Material. A photo ionization detector (PID) must be used to monitor worker's breathing zone for VOCs and a particulate air monitor used for dust and particulate matter. Monitoring must be done by an IH under the direction of a CIH. All data must be reviewed, and documents must be signed and stamped by a CIH.
7. Include decontamination requirements, work zone identification, and a contingency and emergency plan.
8. Include hospital emergency contact information and a hospital route map.
9. Signature and stamp of the CIH who prepared the HASP.

The HASP must identify potential hazards to health and the environment associated with handling and sampling material and liquid contaminated with potentially hazardous substances and petroleum hydrocarbons. These handling and sampling operations include:

1. Excavating
2. Drilling
3. Contaminated material and contaminated liquid removal
4. Sampling contaminated material and contaminated liquid
5. Decontaminating reusable equipment
6. Transporting samples to the analytical laboratory
7. Containerizing, stockpiling, storing, transporting, and removing contaminated material and contaminated liquid

#### **14-11.11A(4)(d) Sampling and Analysis Plan**

Submit a draft SAAP within 30 days of contract approval and before starting job site work. The sampling and analysis plan must be prepared under the direction of a California Professional Geologist, Certified Engineering Geologist, or Professional Civil Engineer and has 3 or more years experience in hazardous waste investigation and remediation. The final SAAP must be signed and stamped by the licensed professional and submitted for review and acceptance within 5 days after receipt of comments. If the final accepted SAAP is incomplete based on these contract special provisions, the Engineer will require you to revise and amend the SAAP with no additional compensation to you.

The SAAP must discuss excavation and construction involving contaminated materials and contaminated liquid, including:

1. Information on the lateral and vertical extent of excavation
2. Number, depth, and location of samples
3. Describe the sampling methodology and analytical parameters
4. Detection limits
5. Field screening methods
6. Decontamination procedures
7. Management of soil cuttings, water, and decontamination water

The SAAP must list criteria for waste profile characterization of the excavated contaminated material and containerized contaminated liquid generated from each property to determine whether the waste is unregulated, designated waste, non-RCRA (California) hazardous waste, or RCRA hazardous waste. The SAAP must also include disposal options (e.g., Class 3, Class 2, or Class 1).

The SAAP must meet the specifications contained in USEPA, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (SW-846), Volume II: Field Manual, Chapter Nine, Section 9.1. The SW-846 specifications apply to the design and development of the sampling plan, statistical analysis, and reporting of test results. The SAAP specifications must be performed under these Contract Special Provisions, as required by the disposal facility accepting the excavated contaminated material and containerized contaminated liquid. Deviations from specifications must be accepted in advance, and in writing.

The SAAP must include:

1. Description of activities
2. Data quality objective process, including:
  - 2.1 Project task and problem definition
  - 2.2 Data quality objectives
  - 2.3 Data quality indicators
  - 2.4 Data review and validation
  - 2.5 Data management
3. Excavation, contaminated material and contaminated liquid segregation methodology, and staging area locations
4. Sampling rationale, including:
  - 4.1 Analytes of concern for each contaminated industrial property
  - 4.2 Specific EPA analytical methods and detection limits for each contaminant (contaminated material and contaminated liquid) for each excavation area
  - 4.3 Collection and analysis of samples from contaminated material stockpiles and contaminated liquid containers within seven days after first placement of contaminated material and contaminated liquid in staging area, as specified in the accepted SWSA
  - 4.4 Proposed number of samples for contaminated material for each contaminated area based on EP volume estimates, including:
    - 4.4.1 Minimum of five soil samples per 100 cubic yards contaminated material stockpile analyzed separately with no composite sampling
    - 4.4.2 Minimum of four soil samples collected and analyzed separately with no composite sampling for contaminated material stockpiles excavated from a property with less than 100 cubic yards, as discussed in the EP
    - 4.4.3 Contaminated material samples distributed laterally and vertically across the stockpile to provide a representative cross section of soil quality

- 4.5 Proposed number of samples for contaminated liquid for each contaminated industrial property, including:
  - 4.5.1 Specify size of container for contaminated liquid storage
  - 4.5.2 Minimum of two samples from each contaminated liquid container
5. Field methodologies and procedures for contaminated material and contaminated liquid sampling, including:
  - 5.1 Step-by-step standard sampling protocol (with appropriate equipment) for contaminated material and contaminated liquid samples
  - 5.2 Contaminated material sampling, including:
    - 5.2.1 Contaminated material samples collected a minimum of 12 inches below the soil surface
    - 5.2.2 Minimum of two contaminated material samples collected at a distance of half the stockpile height below stockpile surface
    - 5.2.3 Special collection and analytical methods to prevent the loss of volatile and unstable compounds
  - 5.3 Contaminated liquid sample collection from different areas within the container
  - 5.4 Sample containers for contaminated material and contaminated liquid and method of preservation for each matrix and analysis
  - 5.5 Discussion of field documentation such as sample identification, labeling, field logs, boring logs, and chain of custody
  - 5.6 Sample identification for each contaminated material stockpile and contaminated liquid container clearly labeled to identify the property by name, address and Caltrans parcel number as specified in the EP and SWSA
  - 5.7 Packaging and shipping methods
6. Sample handling procedures, including:
  - 6.1 Samples collected and transferred in a new or laboratory-certified clean container under proper chain of custody to an environmental laboratory accreditation program (ELAP) certified laboratory within 24 hours after collection
  - 6.2 Samples analyzed within the holding times specified in SW-846 test methods for evaluating solid waste
7. Decontamination, including:
  - 7.1 Reusable excavation and sampling equipment decontamination at the end of each work day, as specified in the EP
  - 7.2 Reusable equipment decontamination after completion of work on each individual contaminated industrial property identified on the plans
  - 7.3 Equipment decontamination before moving to another contaminated industrial property
  - 7.4 Excavation equipment steam-cleaned prior to use, steam-cleaned or decontaminated between contaminated industrial properties, and steam-cleaned or decontaminated at the end of each work day
  - 7.5 Reusable equipment decontaminated after each use and consist of scrubbing with a brush, washing with a non-phosphate detergent, and triple rinsing with de-ionized water
  - 7.6 Water and solution used for decontamination treated as IDW and disposed in the appropriate staging area contaminated liquid container, segregated by property, as specified in the accepted SWSA and EP
  - 7.7 Discussion of necessity to follow decontamination procedures to prevent cross contamination
8. Disposal of staging area contaminated material, contaminated liquid, and IDW, including:
  - 8.1 IDW generated during contaminated material excavation, contaminated liquid extraction, or sampling placed in the staging area stockpile and/or container, segregated by property, as specified in the accepted SWSA and EP
  - 8.2 Discussion on the methodology and management of staging area contaminated material, contaminated liquid, and IDW
  - 8.3 Discussion on disposal of excavated contaminated material and contaminated liquid when characterized as contaminated
  - 8.4 Discussion on management of decontaminated IDW
  - 8.5 Maximum 45 days allowable storage time for staging area contaminated material, contaminated liquid, and IDW
9. Quality control/quality assurance (QC/QA) laboratory and field procedures, including:
  - 9.1 Field QC sample collection procedures (duplicates, travel blanks, equipment blanks, field blanks)
  - 9.2 QC samples analyzed for the same constituents as the associated contaminated industrial property samples

- 9.3 QC samples labeled in a similar fashion as the contaminated industrial property samples without identifying the property
10. Statistical analysis of the sample data in accordance with EPA SW-846 test methods for evaluating solid waste
  11. Schedule for field work and SWSR draft and final submittal

Contaminated materials and contaminated liquid samples must be analyzed under EPA methods and satisfy the disposal facility requirements. EPA and Cal-EPA analytical methods must include analysis for:

1. Metals by method 6010
2. Soluble metals by California Waste Extraction Test (CA WET) (if total metal greater than 10 times the soluble threshold limit concentration (STLC))
3. Soluble lead by DI WET
4. Soluble lead by toxicity characteristic leaching procedure (TCLP)
5. Hexavalent chromium by method 7196A or 7199
6. pH by method 9045
7. Total petroleum hydrocarbons (TPH) for gasoline by sample collection and preparation by method 5035 and for diesel oil, and grease by method 8015 modified
8. VOCs, including oxygenates by method 8260 and sample collection and preparation by method 5035
9. Semi-volatile organic compounds (SVOCs) by method 8270
10. Pesticides by method 8081
11. Polycyclic aromatic hydrocarbons (PAHs) by method 8310
12. Polychlorinated biphenyls (PCBs) by method 8082
13. Other analytic methods specific to the constituent under USEPA, "Test Methods for Evaluating Solid Waste" (SW-846)
14. Asbestos

#### **14-11.11A(4)(e) Soil and Water Sampling Report**

Submit a SWSR within 15 days of completing a sampling event. The SWSR must be prepared, signed, and stamped by a Professional Geologist or Professional Civil Engineer overseeing the work. The final SWSR must be signed and stamped by the licensed professional and submitted for review and approval within 5 days after receipt of comments.

The SWSR must provide detailed descriptions of sampling activities, itemized by each property and include:

1. Title sheet with project name, location, contract number, your name, the name of the author and date prepared
2. Signature page with signature, title, stamp, and professional registration of the California licensed project geologist
3. Table of contents
4. Summary of the investigation findings and characterization of contaminated material and contaminated liquid by parcel
5. Project description
6. Introduction that includes general objectives of fieldwork, a brief history of site activities, previous site work, and completed work
7. Description of investigative or field methods for each parcel, including:
  - 7.1. Activities
  - 7.2. Field methodology
  - 7.3. Procedures for excavating, stockpiling, sampling, containerizing, and removing contaminated material and contaminated liquid
  - 7.4. Sampling methodology
  - 7.5. Parcel identification
  - 7.6. Stockpile sampling locations
  - 7.7. Source of contaminated liquid samples and container locations
  - 7.8. QC/QA
  - 7.9. Decontamination
  - 7.10. IDW management
  - 7.11. Deviations from the accepted SAP

8. Investigative results and field observation presented in table format with previous work or results, including:
  - 8.1. Observed site geology
  - 8.2. Chemical test results
  - 8.3. Laboratory QC/QA
9. List of regulatory contacts
10. Mapping, data evaluation and discussion of site investigation or field activity results evaluated by property, including:
  - 10.1. Sites with environmental feature locations
  - 10.2. Borings and wells
  - 10.3. Staging areas
  - 10.4. Contaminated material stockpiles and contaminated liquid container locations
  - 10.5. Contaminated material stockpile sampling locations
  - 10.6. Title blocks, scale, and north arrow
  - 10.7. Estimates of contaminated material and contaminated liquid volumes with assumptions and calculations
  - 10.8. Charts, maps, cross sections, and graphs displaying contamination levels of contaminated materials and contaminated liquids in specific, identifiable locations
  - 10.9. Color photographs documenting site surroundings, investigation areas with boring locations flagged, and significant geological features.
  - 10.10. Statistical analysis of sample results, estimating trend, contaminant distribution and average concentrations including:
    - 10.10.1. Mean, median, standard deviation, 90 and 95 percent upper confidence limits (UCL) with histograms of the original data and transformations (arcsine or square root) in accordance with SW 846
    - 10.10.2. Arcsine data transformation used to determine the confidence interval and referenced or reproduced
  - 10.11. Conclusions and recommendations for waste classification and disposal or relinquishment based upon the data and lateral extent of contamination
  - 10.12. Appendices containing data to support the discussion, calculations, estimates, and recommendations, including complete laboratory reports with chromatographs. Chromatographs must be on file and provided upon request.
  - 10.13. Laboratory test reports, including:
    - 10.13.1. Name of analytical laboratory
    - 10.13.2. Laboratory address
    - 10.13.3. Laboratory telephone number
    - 10.13.4. Laboratory number for each reported sample
    - 10.13.5. Your number for each sample reported, if applicable
    - 10.13.6. Sample collection date
    - 10.13.7. Date for samples received by laboratory
    - 10.13.8. Laboratory testing date
    - 10.13.9. Brief sample description
    - 10.13.10. Specific test method
    - 10.13.11. Extraction method
    - 10.13.12. Test results for each sample and method
    - 10.13.13. Detection method for each test method
    - 10.13.14. Explanation of higher detection limits, laboratory contaminants, or other unusual results
    - 10.13.15. Samples that failed QC/QA and reason
    - 10.13.16. Test report date
    - 10.13.17. Signature and title of laboratory director
    - 10.13.18. Accepted HASP
    - 10.13.19. Chain of custody documents
    - 10.13.20. Boring and trenching logs, if applicable
    - 10.13.21. Excavation plan showing the excavated footprint at each parcel

**14-11.11A(4)(f) Transportation and Disposal Plan**

Submit a TDP within 15 days before starting any job site work. The final TDP must be signed by the contractor's project manager supervising the preparation of the TDP. The TDP must include discussion

of all contaminated material and contaminated liquid based on the analytical results and as categorized in the conclusions and recommendations of the accepted final SWSR. The TDP must comply with the rules and regulations of DTSC and Cal-OSHA and describe methods and procedures to minimize potential health, safety, and environmental risks during on-site and off-site transport.

The TDP must include:

1. Transportation, safety, and disposal schedules
2. Locations of contaminated material and contaminated liquids
3. Analytical results of sampling and analysis
4. Characterization of contaminated material to be transported, including:
  - 4.1. Description of appearance
  - 4.2. Source
  - 4.3. Quantity
  - 4.4. Nature of contaminants and associated hazards
5. Dust control measures
6. Air Monitoring
7. Transporter identification and proof of valid hauler registration
8. Location, type, number, and capacity of equipment, containers, and transport vehicles
9. Sampling frequency and methodology for contaminated material and contaminated liquid not previously characterized
10. Identification of analytical laboratory certified by ELAP
11. Truck loading and staging areas
12. Transportation routes from each contaminated area of excavation to staging areas
13. Transportation equipment and routes to and from disposal facilities, including:
  - 13.1 Alternate routes, maps, and preferred routes that avoids schools and residential areas, peak traffic hours, and hazardous road conditions
  - 13.2 Estimated round trip time
  - 13.3 Maximum and average round trips per day
14. Traffic control and loading procedures for entering and leaving the job site, including:
  - 14.1 Avoiding schools and residential areas
  - 14.2 Address local traffic, peak traffic hours, and hazardous road conditions
  - 14.3 Identify lane closure, flagging, and traffic control measures
15. Truck decontamination before leaving loading areas, including where and how trucks will be decontaminated
16. Vehicle inspection before leaving the staging areas to ensure proper loading, covering, decontamination, placarding, and manifesting
17. Method to prevent spilling and tracking contaminated materials and contaminated liquids onto public roads
18. Record keeping, including:
  - 18.1. Date and time
  - 18.2. Weight and volume of contaminated material or contaminated liquid
  - 18.3. Type of waste
  - 18.4. Trucking company, driver, vehicles used, and documents carried with the load
19. HASP
20. Spill contingency plan
21. Permitted California disposal or recycling facilities that will accept contaminated material and contaminated liquid

#### **14-11.11A(5) Quality Control and Quality Assurance**

Analytical laboratories must be certified by the California Department of Public Health (DPH). You are responsible for sample transportation from the job site to the laboratory, providing decontaminated (certified clean) or new sample containers, labels, appropriate preservation, and chain of custody records.

You must provide a clear and accurate explanation of laboratory analytical results including graphical presentations and summaries of the laboratory data in reports. Based upon test results and professional judgment, you must make recommendations of the options for disposal and recycling of staging area contaminated material, contaminated liquid, and IDW.

#### **14-11.11A(5)(a) QC/QA for Field and Laboratory**

Laboratory QC/QA is used to evaluate the accuracy and precision of analytical data to establish data quality, data validation, provide indication of need for corrective action, and determine effect of corrective action. QC/QA must be performed for each method of analysis. Data must be reported in summary form. QC/QA reports must include:

1. Temperature of incoming samples
2. Constituent/analyte
3. EPA test method
4. Date of receipt and analysis (include holding time table for more than 50 samples)
5. Detection limits and unit of measure for the specific test method
6. Percent accuracy
7. Percent precision
8. Signature of laboratory manager or director

Laboratory QC/QA procedures specified by each test method must include analysis of:

1. One method blank for every 10 samples, batch of samples or type of matrix, whichever is more frequent
2. One spiked sample for every 10 samples, batch of samples or type of matrix, whichever is more frequent, with spikes made at 10 times the detection limit or at the analyte level
3. One sample analyzed in duplicate for every 10 samples, batch of samples or type of matrix analyzed in the laboratory, whichever is more frequent
4. Samples spiked with surrogates

#### **14-11.11A(5)(b) Field Quality Control/Quality Assurance (Field QC/QA)**

Documentation of pre-field activities, field activities, post-field activities, and deviations, including:

1. Collection of one duplicate sample per 20 samples or one per batch of samples
2. One equipment blank for every chain of custody by pouring de-ionized water onto the decontaminated sampling device and collecting the water in a laboratory container
3. One trip blank for every ice chest or sample shipment container used to store samples for analysis of VOCs (contents of each ice chest or refrigerated container constitutes an individual group of samples)
4. One laboratory prepared trip blank for each individual groups of samples transported
5. Collection of field blanks (clean water samples prepared at the site in the same location as field sampling and handled in the same manner as the site samples)
6. Calibration of field test instruments and measuring gauges, including:
  - 6.1 Equipment complying with the manufacturer recommended calibration schedule
  - 6.2 Calibration records filed and available for inspection
7. Sample handling and preservation, including:
  - 7.1 Placing in new or sterilized containers
  - 7.2 Containers certified clean
  - 7.3 Preserved at 39 degrees F
  - 7.4 Delivered to the laboratory with 24 hours
  - 7.5 Containers with preservative supplied with the laboratory if chemical preservation of a sample is required

Where the test method does not specify QC/QA procedures, the above applies.

You must obtain new samples at your expense if QC/QA data shows:

1. Cross contamination
2. Samples were analyzed beyond their holding time
3. Samples were compromised while in your custody prior to delivery for analysis
4. The chain of custody was broken
5. Sample collection methodology was not followed
6. Incorrect analysis was performed
7. Samples were not handled or preserved properly
8. Signature of laboratory manager or director not present on chain of custody

## **14-11.11B MATERIALS**

Not Used

## **14-11.11C CONSTRUCTION**

### **14-11.11C(1) General**

Equipment must be decontaminated at the end of each day.

Decontaminate equipment after completing work on one parcel before starting work on another parcel.

Segregate contaminated material from uncontaminated soil and stockpile contaminated material in staging areas.

The maximum stockpile volume is 100 cubic yards. Contaminated material stockpiles must remain separated. Do not combine, mix, or stack contaminated material stockpiles.

Excavation of additional contaminated material resulting from slope excavations instead of shoring or excavation operations outside the pay limits is at your expense. You must verify the condition of excess contaminated material and handle excess contaminated material in accordance with local, state, and federal regulations. You are responsible for waste generation from slope excavations and must process all waste manifests for off-site disposal purposes.

If contaminated material or contaminated liquid is encountered outside of the areas shown, stop work and notify the Engineer.

### **14-11.11C(2) Material Management**

Contaminated material, contaminated liquid, and IDW must be placed in separate stockpiles or containers and segregated by property in the designated staging areas as shown on the accepted SWSA.

Stockpile contaminated material in designated staging areas on top of 60-mil high density polyethylene impermeable barrier or equivalent. If stockpiles are on a paved surface, the barrier may be 20-mil high density polyethylene impermeable barrier or equivalent.

The impermeable barrier seams must be sealed and the barrier must exceed the dimensions of the contaminated material stockpile. The contaminated material stockpile perimeter must be bermed with clean soil.

Wet the contaminated material stockpile and cover with 13-mil polyethylene and secure with sandbags. Label contaminated material stockpiles to identify the property by name, address, and parcel number.

Contaminated material that is soil saturated with water or free product must be placed in leak tight USDOT compliant containers, segregated by property, and placed in the designated staging area. Contaminated material containers must be labeled to identify the property by name, address, and parcel number.

Leak tight USDOT compliant containers must be used for contaminated liquid. Label containers to identify the property by name, address, and parcel number.

Contaminated material stockpile and contaminated liquid container storage must not exceed 45 days from the time of initial placement within the staging area. If contaminated material stockpiles and contaminated liquid containers remain in any staging area after 45 days, the Engineer will contact a third party contractor to complete any outstanding waste profiling activities and remove the contaminated material and contaminated liquid from the staging area. The Department deducts all costs incurred for this process, including workday credit to the State, for your delay.

Contaminated material and contaminated liquid must not be reused on the job site. Dispose of contaminated material and contaminated liquid off the job site, at an appropriate facility, based on the analytical laboratory profiling.

Disposable equipment, PPE, and IDW must be collected and removed from the job site.

### **14-11.11C(3) Sampling**

Contaminated material and contaminated liquid samples must be prepared under the responsible charge of a California Professional Geologist, Certified Engineering Geologist, or Professional Civil Engineer with

3 or more years of experience in hazardous waste investigation and remediation. Samples must be collected in new or laboratory certified containers and transferred, under the proper chain of custody, to an ELAP certified analytical laboratory within 24 hours of collection.

Notify the Engineer 5 days before starting sampling.

Contaminated material stockpiles and contaminated liquid containers stored in the staging areas must be sampled within seven days of initial placement and samples sent to the analytical laboratory for analysis. If the soil and water sampling requirement is not completed within seven days, the Engineer will contact a third party contractor to complete any outstanding waste profiling activities and remove the contaminated material and contaminated liquid from the staging area. The Department deducts all costs incurred for this process, including workday credit to the State, for your delay.

Calibrate all necessary field instruments at the start and end of each day or as the manufacturer recommends.

Decontaminate reusable equipment after use by scrubbing, with a brush and non-phosphate detergent, and triple rinsing with deionized water. IDW generated during decontamination must be placed in containers segregated by property. Remove disposable equipment and PPE.

#### **14-11.11C(4) Monthly Progress Reports**

You must submit monthly progress reports after starting excavation of contaminated materials and extraction of contaminated liquids. The monthly progress report must contain a summary and information for each property, including:

1. The names and titles of workers on the job site during the reporting period
2. Detailed description of work, including:
  - 2.1. Contaminated material excavation
  - 2.2. Contaminated liquid extraction
  - 2.3. Transportation to staging areas
  - 2.4. Sampling
3. Dates when each stockpile or container began receiving contaminated material and contaminated liquid in the staging areas including the parcel number
4. Volumes of contaminated material and contaminated liquid removed and placed in staging area
5. Figure showing contaminated material stockpile sampling locations
6. Confirmation that decontamination was completed at the end of the day and after completion of work on each individual contaminated industrial property
7. Proper IDW management
8. Copies of analytical laboratory reports, boring logs, and field reports with field and laboratory QA/QC procedures
9. Summary of problems and resolution
10. List of deviations and the reason for the deviations
11. Violations
12. Work schedule and deliverables submittal with a schedule for the next reporting period
13. Copies of shipping documents and manifests removed during the reporting period

#### **14-11.11C(5) Dust Control**

In addition to 14-11.02C, job site work must comply with SCAQMD Rule 403-Fugitive Dust.

#### **14-11.11C(6) Material Transportation**

Before leaving the staging area and traveling on public roads, remove loose and extraneous contaminated material from truck tires and surfaces outside the cargo areas of the transporting vehicles and cover the cargo with tarpaulins or cover, as outlined in the accepted TDP. You are responsible for costs due to spillage of contaminated material and contaminated liquid during transport. Transportation routes for Type Y-1 or Y-2 contaminated material must only include the highway.

Contaminated material and contaminated liquid must be transferred directly from staging areas to registered vehicles and containers approved for transportation by the USDOT. You must transport and dispose of all contaminated material and contaminated liquid characterized as hazardous waste at a permitted facility in California in conformance with Division 4.5 of Title 22 of the California Code of Regulations, Section 2521 of Title 23 of the California Code of Regulations, and Section 7-1.13, "Disposal

of Material Outside the Highway Right of Way" of the Standard Specifications, and these Contract Special Provisions.

**14-11.11D PAYMENT**

Hazardous Materials Mitigation Plans includes preparing, revising, submitting, and implementing the SWSA, EP, HASP, SAP, SWSR, and TDP as specified in the Standard Specifications and these Contract Special Provisions, and as directed by the Engineer.

The handling and disposal of hazardous contaminated materials and hazardous contaminated liquids is change order work.

The Department does not pay for additional stockpiling unless the stockpiling is ordered. The Department does not pay for additional sampling and analysis unless it is ordered. The Department does not pay for additional sampling and analysis required by the receiving landfill.

The Department does not pay for excavation of contaminated material from excavation outside of the pay limits.

Sampling, analyses, and reporting of results for surplus contaminated material not previously sampled is change order work.

\*\*\*\*\*

**15 EXISTING FACILITIES**

**Replace section 15-2.02C(2) with:**

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

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

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

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

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

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

**Replace section 15-2.02I with:**

**15-2.02I Remove Sign Structures**

Removing overhead sign structures includes removal of:

- 1. Frames, braces, supports, and brackets
- 2. Portions of foundations
- 3. Sign panels
- 4. Mounting hardware for light fixtures
- 5. Walkways, safety railing, gutter
- 6. Electrical equipment for sign lighting
- 7. Hardware
- 8. Posts
- 9. Portions of foundations

Concrete foundations may be abandoned in place except that the top portion, including anchor bolts, reinforcing steel, and conduits, must be removed to a depth of not less than 2 feet below the adjacent finished grade. The resulting holes must be backfilled and compacted with material that is equivalent to the surrounding material.

Removing bridge mounted sign structures includes removal of:

1. Frames, braces, supports, and brackets
2. Portions of foundations
3. Sign panels
4. Mounting hardware for light fixtures
5. Walkways, safety railing, and gutter
6. Electrical equipment for sign lighting
7. Hardware

Remove signs' conduit and wiring to the nearest pull box. Remove fuses within spliced connections in the pull box.

**Add to section 15-2.02K:**

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

A pipe plug must be one of the following:

1. Wall of minor concrete not less than 6 inches thick
2. Tight brick wall not less than 8 inches thick with cement mortar joints

Payment for plugging or sealing the pipes or existing structures is included in the payment for remove pipe involved.

Payment for removing flared end section at the end of the pipe is included in the payment for remove pipe involved.

**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 or Los Angeles County South Sewer Maintenance Yard, notify the Engineer.

For salvaging Model 334 controller cabinets, and service equipment enclosures, the Department salvage storage location is:

Norwalk Electrical Maintenance Yard  
7316 Bandini Blvd., Los Angeles, CA 90040

For salvaged manhole frame and cover, Los Angeles County South Sewer Maintenance Yard location is:

Los Angeles County South Sewer Maintenance Yard  
12015 Shoemaker Ave., Santa Fe Springs, CA 90670  
Telephone (562) 941-7011

**Replace 1st paragraph in section 15-4.01C(2)(b) with:**

Provide protective covers for removal work over traffic, railroad property and channel. Protective covers must:

1. Be constructed before starting removal activities.
2. Prevent any materials, equipment, or debris from falling onto traffic, railroad property and channel.
3. Be supported using shoring, falsework, or the existing structure.
4. Be cleaned of debris and fines before being removed.



**Add to section 19-6.03D:**

Settlement periods and surcharges are required for bridge approach embankments as shown in the following table:

Bridge name or number	Abutment number	Bent number	Surcharge height (feet)	Settlement period (days)
Br. no 53-3045	Abut SA1		7.0	90
	Abut SA21		5.0	90
	Abut 11 (stage 1)		7.0	90
	Abut 11 (stage 2)		7.0 (or 2.0)*	90
Br. no 53-3059K	Abut 1		12.0	90
Br. no 53-3044	Abut 1,4,& 5 (stage 1)		3.0	90
Br. no 53C-2194	Abut 1, 4 & 5		3.0	90
Br. no.53-3058K	Abut 4		12.0	90
Br. no.53C-2295	Abut 1		9.0	90
Br. no.53C-2296	Abut 4		12.0	90

\*Limited area in 2nd stage requires only 2-foot surcharge. The 2-foot surcharge must be limited to 40 feet from stage transition line transversely, and 50 feet from centerline of Abutment 11 longitudinally.

Settlement periods and surcharges are required for roadway embankments at the earth retaining structures as shown in the following table:

Earth retaining structure number	Surcharge height (feet)	Settlement period (days)
70	7	90
73	6	90
80	2	90
VA85	5	90
SF3	5	90
SF4	5	90
DW87	6	90
DW88	6	90
VA87	7	90
VA88	7	90
VA107	7	90
VA108	7	90
VA109	2	90
DW108	2	90
DW109	2	90
NF66	7	90
NF65	7	90
VA103	7	90
VA104	7	90
68 and 69	12	90
52 and 55	12	90
FIR4 and FIR5	9	90
FIR7 and FIR8	12	90
2 (STA 12+47 to 17+46)	5	90
8	5	90
NF60	5	90
NF62	2	60
AC60	2	60
AC62	2	60



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

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

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

**Add to section 20-2.06B of the RSS for section 20:**

Flow sensor cable must be rated 600V and 194 degree F, be UL listed as Type TC, meet requirements of ICEA/NEMA, and comply with the following:

1. Consist of two no. 16 minimum stranded copper conductors. Insulated conductor must be color coded with a PVC or nylon jacket.
2. Include a tinned cooper braid or aluminized polyester film shield. Where the film is used, a no. 18 (or larger stranded) or no. 16 (solid), tinned, copper drain wire to be placed between the insulated conductors and the shield and in contact with the conductive surface of the shield.
3. Include a black PVC jacket with a minimum nominal thickness of either 50 mils or 48 mils where capacitance of conductors to other conductors and the shield is 87 pF/ft or better. The cable jacket must be marked with the insulation type designation, conductor size, and voltage and temperature ratings.
4. Have an outside diameter of 0.29 to 0.35 inch.
5. Be UV resistant and direct burial type.
6. Have no splices between components.

**Add to the list in the 1st paragraph of section 20-2.07B(2)(a) of the RSS for section 20:**

17. Be EPA WaterSense® approved.

**Add after the 1st paragraph of section 20-2.07B(2)(a) of the RSS for section 20:**

Before the irrigation system functional test begins, furnish 2 remote access devices to the Engineer.

**Add to section 20-2.07B(2)(a) of the RSS for section 20:**

The irrigation controllers within Department highway areas must be ET Water and must have 2-way communication by any web-enabled device. The vendor must install any necessary software and conduct any initial software or proprietary website setup configuration for communications between controller and any web-enabled device.

You may obtain specified equipment listed below from:

Company: Imperial Technical Services  
Address: 4930 E. Landon Dr., Anaheim, CA 92807  
Business phone number: (714) 792-2920  
Fax phone number: (714) 696-7545

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

Equipment description	Quoted price	Quantity	Extended price	Controller identification
ETWATER 8 station controller wireless, 205W-8 with ITSOPT ET WATER wireless antenna Hi Gain, ANT-ETW and ETWater Platinum Data Service Plan, with 4 add'l yrs ETW-MGR-5CP	\$2,879.25	1	\$2,879.25	'F'
ETWATER 16 station controller wireless, 205W-16 with ITSOPT ET WATER wireless antenna Hi Gain, ANT-ETW and ETWater Platinum Data Service Plan, with 4 add'l yrs ETW-MGR-5CP	\$3,119.25	2	\$6,238.50	'NV' and 'SV'

These prices are good until 10/16/2016.

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

1. Be cold-rolled steel.

**Delete items 2.2, 2.3 and 2.4 in the list in the 1st paragraph of section 20-2.07B(3) of the RSS for section 20.**

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

A single irrigation controller enclosure cabinet must be 35 inches high by 23 inches wide by 17 inches deep.

**Replace the 1st paragraph in section 20-2.11B(2) of the RSS for section 20 with:**

Ball valve must be PVC or chlorinated PVC and must comply with the requirements shown in the following table:

Property	Requirements
Nonshock working pressure for 3/4 to 4 inch valves, min	235 psi
Nonshock working pressure for 6 inch valves, min	150 psi
Seats	PTFE
O-ring seals	EPDM or fluoroelastomer

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

2. Be glass filled nylon.

**Replace the 2nd sentence in the 1st paragraph of section 20-3.01B(3) of the RSS for section 20 with:**

Soil amendment must be sphagnum peat moss.







# DIVISION VI STRUCTURES

## 48 TEMPORARY STRUCTURES

### Add to section 48-2.01C(2):

The review time for shop drawings for specific structures or portions of structures is shown in the following table:

Structure or portion of structure	Total review time
(Br. No 53-3045)	70 days

### Replace "Reserved" in section 48-6 with: 48-6 TEMPORARY WOOD POLES

#### 48-6.01 GENERAL

##### 48-6.01A Summary

Section 48-6 includes specifications for constructing, maintaining, and removing temporary wood poles for the support of electrical.

##### 48-6.01B Definitions

**temporary wood pole:** Round timber pole and any attached structural components with no more than 5 years of anticipated service before removal or replacement.

**Overhead conductor:** A conductor or cable supported overhead.

**Overhead bundle:** An assembly consisting of a messenger wire, one or more overhead conductors, and one or more lashing wires.

**Temporary wood post:** A square or rectangular timber with no more than 5 years of anticipated service before removal or replacement.

##### 48-6.01C Submittals

##### 48-6.01C(1) General

Submit a letter of certification that certifies all components of the manufactured assemblies are used in compliance with the manufacturer's recommendations. If requested, (1) submit manufacturer's data for manufactured assemblies to verify manufacturer's recommendations, or (2) perform tests demonstrating adequacy of the proposed assemblies.

Submit a letter of certification for all temporary structural support members with field welded splices. The letter must certify that all welding and NDT, including visual inspection, comply with the Contract and the welding standard shown on the shop drawings. The letter must be signed by an engineer who is registered as a civil engineer in the State. Submit the letter before installing messenger wires, tether wires, or luminaire arms.

Submit a welding certification for temporary structural support members with previously welded splices. The certification must:

1. Itemize the testing and inspection methods used
2. Include tracking and identifying documents for previously welded members
3. Be signed by an engineer who is a registered civil engineer in the State
4. Be submitted before erecting the members

##### 48-6.01C(2) Guy Wire Anchors

Submit the guy wire anchor manufacturer's product information and installation instructions. Do not install anchors unless authorized.

##### 48-6.01D Quality Control and Assurance

##### 48-6.01D(1) General

Reserved

#### **48-6.01D(2) Welding and Nondestructive Testing**

Welding must comply with AWS D1.1 or other recognized welding standard except (1) for previously welded splices, and (2) if fillet welds are used where load demands are 1,000 lb or less per inch for each 1/8 inch of fillet weld.

Perform NDT on splices made by field welding at the job site. You may use UT or RT. Each field weld and any repair made to a previously welded splice must be tested. You must select locations for testing. The length of a splice weld where NDT is to be performed must be a cumulative weld length equal to 25 percent of the original splice weld length. The cover pass must be ground smooth at test locations. Acceptance criteria must comply with the specifications for cyclically loaded nontubular connections subject to tensile stress in clause 6 of AWS D1.1. If repairs are required in a portion of the weld, perform additional NDT on the repaired sections. The NDT method chosen must be used for an entire splice evaluation, including any repairs.

For previously welded splices, you must determine and perform all necessary testing and inspection required to certify the ability of the temporary structural support members to sustain the design stresses.

#### **48-6.02 MATERIALS**

##### **48-6.02A General**

Wire used for messenger wires, tether wires, and guy wires, must comply with ASTM A475, Utilities Grade, 7-wire strand.

Weights and diameters of overhead conductors must not exceed those shown by more than 5%.

Connection hardware for wires must provide termination efficiency factor of not less than 0.80.

Wood poles, push braces, and stubs must comply with Alliance for Telecommunications Industry Solutions O5.1.

Treat wood under AWWA U1, Use Category UC4B, Commodity Specification D.

Other steel components must comply with section 86.

##### **48-6.02B Helical Anchors, Expanded Steel Plate Anchors, Cross Plate Anchors, and Expanding Rock Anchors**

Fabricate helical anchors, expanded steel plate anchors, and cross plate anchors under section 55.

Fabricate attachable thimble eyes and expanding rock anchors from suitable ferrous material.

Welding must comply with AWS D1.1.

Fabricate as a continuous piece or as separate segments with mechanical connections between segments. Include integral thimble eye or include attachable thimble eye.

Galvanize all helical anchor parts under section 75.

Paint expanded steel plate anchors, cross plate anchors, and expanding rock anchors as specified for repairing damaged galvanized surfaces in section 75-1.05.

The final assembly must have (1) a minimum ultimate tension strength greater than the minimum required breaking strength of the guy wire, and (2) a minimum ultimate torsion strength greater than twice the minimum installation torque.

##### **48-6.02C Reuse of Materials and Relocation of Temporary Supports**

You may reuse structural components and relocate temporary supports provided that the materials remain in acceptable condition for reuse, except do not reuse:

1. Components of galvanized high-strength-bolt assemblies that have been or are required to be tensioned past snug tight
2. Galvanized high-strength cap-screws that have been or are required to be tensioned past snug tight
3. Tension control bolts

## **48-6.03 CONSTRUCTION**

### **48-6.03A General**

Install construction bracing as necessary to withstand all imposed loads during erection, construction, and removal of any temporary structural supports.

Install Type K temporary railing on both sides of vehicular openings through temporary structural supports. The Engineer may order you to install temporary railing at other temporary structural supports less than 12 feet from the edge of a traffic lane.

Install all temporary railing protecting temporary structural supports before erecting temporary structural supports. Do not remove temporary railing until authorized.

For overhead line construction not specifically covered in the contract documents, comply with Public Utility Commission General Order No. 95

### **48-6.03B Foundations**

Verify the design soil parameters before starting construction of temporary wood poles.

Remove any accumulated water from the pole excavation prior to placing granular backfill at the bottom of the pole excavation. Thoroughly compact and level the granular backfill at the bottom of pole excavation prior to setting pole.

Backfill around poles with manufactured sand that is free of rocks or other deleterious material. Place the backfill material in 4-inch thick layers. Moisten and thoroughly compact each layer.

Install required pull boxes at least 2 feet clear from face of pole.

Remove accumulated water from the anchor excavation prior to placing expanded steel anchor. Expand the base of the expanded steel anchor prior to placing backfill. Place backfill around expanded steel anchor in 4-inch thick layers. Thoroughly compact each layer.

Protect foundations from softening and undermining.

### **48-6.03C Erection**

If temporary structural supports are over or adjacent to roadways or railroads, all details of the temporary structural support system that contribute to horizontal stability and resistance to impact, except for connections in bracing, must (1) be installed at the time each element of the temporary structural support is erected, and (2) remain in place until the temporary structural support is removed.

Suspend overhead conductors from messenger wire by continuous lashing wire. No spare overhead conductors are allowed unless described. Sag the overhead bundles to maintain required clearances and sags over the temperature range of -30 to 120 degrees F. Required sag is between 4.6 percent and 5.4 percent of horizontal span unless shown otherwise. Minimum vertical clearance over grade is 21 feet unless shown otherwise. Sag tether wires to maintain approximately uniform separation from their overhead bundles.

### **48-6.03D Attachments**

If specific connection details are not shown, mount attachments under the manufacturer's written instructions so there is no loss of structural component cross section.

### **48-6.03E Damping**

If at any time during service, the temporary wood poles exhibit excessive vibration, immediately install dampers. Dampers must be effective in mitigating the vibration and must not compromise the temporary wood poles or the supported hardware.

### **48-6.03F Removal**

Remove temporary wood poles so portions not yet removed remain stable at all times.

Remove temporary wood poles and helical anchors. Fill the void with excavated material or sand that is free of deleterious material. Place the backfill material in 4-inch thick layers. Moisten and thoroughly compact each layer.

Dispose of surplus excavated material uniformly along the adjacent roadway.

Dispose of temporary structural support materials and work debris.

#### **48-6.03G Guy Wire Helical Anchors**

##### **48-6.03G(1) General**

Reserved

##### **48-6.03G(2) Installation Parameters**

Use the minimum installation torque shown. You may request an alternative minimum installation torque based on a revised value for empirical torque factor.

For alternative minimum installation torque, use the following equation to calculate the installation torque:

$$T = Q_a(FS/K_t)$$

where:

$T$  = Minimum installation torque, lb-ft

$FS$  = Factor of safety of 2.0

$Q_a$  = Minimum allowable tension capacity shown, lb

$K_t$  = Empirical torque factor, 1/ft (inverse foot)

Include a geotechnical report sealed by a licensed geotechnical engineer with recommended values for empirical torque factor and alternative minimum installation torque with your request.

Do not start installation unless your alternative installation parameters are authorized.

Verify the installation parameters before the start of anchor installation.

##### **48-6.03G(3) Installation**

Install anchor in compliance with manufacturer's written instructions, and:

1. Do not install anchors underneath utilities or subsurface structures
2. Maintain horizontal clearances as required by the Engineer
3. Install to the minimum embedment length
4. Continuously monitor and record torque during installation. If torque at the minimum embedment length is not equal to or greater than the minimum required, continue installation to greater embedment until the minimum installation torque is achieved for 2 feet continuously.

##### **48-6.03G(4) Removal**

After service is complete, remove using reverse torque. Fill the space left behind with excavated material or sand free of deleterious materials. Place the backfill material in 4-inch thick layers. Moisten and thoroughly compact each layer.

#### **48-6.03H Expanded Steel Plate Anchors, Cross Plate Anchors, and Expanding Rock Anchors**

##### **48-6.03H(1) General**

Reserved.

##### **48-6.03H(2) Installation**

Install anchors in compliance with the manufacturer's instructions.

Locate and mark all substructures and utilities. Do not install anchors underneath subsurface utilities or structures.

##### **48-6.03H(3) Removal**

After service is complete, remove anchors to a depth of at least 3 feet below finished grade. Fill the space left behind with sand free of deleterious materials. Place the backfill material in 4-inch thick layers. Moisten and thoroughly compact each layer.



Pile location		Conditions
Bridge no.	Support location	
Br. no. 53-3045 (Valley View Ave OH/OC (replacement))	All Bents, Pier, and Abuts	1.Possible hard driving 2.Perched groundwater and possible deeper confined groundwater zone 3.Vibration monitoring 4.Caving 5.Traffic control
Br. no. 53-3059K (Valley View Ave SB on Ramp)	Abut 1 & 4, Bent 2, 3, 4, & 5	1.Perched groundwater 2.Vibration monitoring 3.Irregular distribution of soil units
Br. no. 53-3058K Valley View Ave SB off Ramp)	Bent 1, 2 & 3, Abut 4	1.Vibration monitoring 2.Irregular distribution of soil units
Br. no. 53C-2295 (NB Valley View Ave/S Firestone Blvd)	Abut 1, Bent 2 & 3	1.Perched groundwater 2.Vibration monitoring 3.Irregular distribution of soil units
Br. no. 53C-2296 (SB Valley View Ave/S Firestone Blvd)	Bent 1, 2 & 3, Abut 4	1.Perched groundwater 2.Vibration monitoring 3.Irregular distribution of soil units 4.Expansive soil
Br. no. 53-E0285 (RWFIR 4) Br. no. 53-E0286 (RWFIR 5)		1.Perched groundwater 2.Vibration monitoring 3.Irregular distribution of soil units
Br. no. 53-E0287 (RWFIR 7) Br. no. 53-E0288 (RWFIR 8)		1.Perched groundwater 2.Vibration monitoring 3.Irregular distribution of soil units 4.Expansive soil
Br. no. 53-E0260 (RW 52) Br. no. 53-E0261 (RW 55) Br. no. 53-E0262 (RW 68) Br. no. 53-E0263 (RW 69) Br. no. 53-E0266 (VA 103) Br. no. 53-E0267 (RW VA 104)		1.Perched groundwater, possible Caving soils 2.Vibration monitoring

**Add to section 49-2.01A(3)(b):**

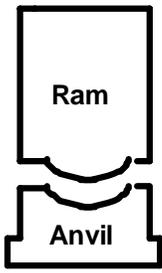
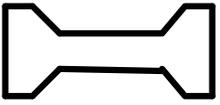
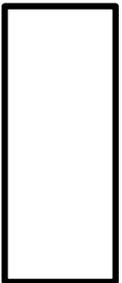
Before installing driven piles, submit a driving system submittal for each pile type for each of the support locations or control zones shown in the following table:

Bridge no.	Pile type	Support location or control zone
Br. no. 53-3045 (Valley View Ave OH/OC (Replace))	CISS	Abut SA1 & SA21, Bent SB2, SB3, SB4, SB5, SB6, SB7, SB8, SB9, SB10, SB11, SB12, SB13, SB14, SB15, SB16, SB17, SB18, SB19, & SB20
Br. no. 53-3045 (Valley View Ave OH/OC (Replace))	Steel pipe pile	Abut 1, Pier 8 Bent 2, 3, 4, 5, 5A, 5B, 5C, 5D, 6, 7, 7A, 7B, 7C, 7D, & 9
Br. no. 53C-2295 (NB Valley View Ave/S Firestone Blvd)	Steel pipe pile	Abut 1, Bent 2 & 3
Br. no. 53C-2296 (SB Valley View Ave/S Firestone Blvd)	Steel pipe pile	Bent 1, 2 ,& 3 , Abut 4
Br. no. 53-3058K (Valley View Ave SB off Ramp)	Steel pipe pile	Bent 1, 2 ,3, Abut 4
Br. no. 53-3059K (Valley View Ave SB on Ramp)	Steel pipe pile	Abut 1, Bent 2, 3,4 & 5

CALIFORNIA DEPARTMENT OF TRANSPORTATION  
 TRANSPORTATION LABORATORY

# PILE AND DRIVING DATA FORM

Structure Name : \_\_\_\_\_ Contract No.: \_\_\_\_\_  
 \_\_\_\_\_ Project: \_\_\_\_\_  
 Structure No.: \_\_\_\_\_ Pile Driving Contractor or  
 Dist./Co./Rte./Post Mi: \_\_\_\_\_ Subcontractor \_\_\_\_\_ (Pile Driven By)

 <p style="text-align: center;"><b>Ram</b> <b>Anvil</b></p>	<b>Hammer</b>	Manufacturer: _____ Model: _____ Type: _____ Serial No.: _____ Rated Energy: _____ at _____ Length of Stroke _____ Modifications: _____ _____ _____						
	<b>Capblock (Hammer Cushion)</b>	Material: _____ Thickness: _____ in Area: _____ in <sup>2</sup> Modulus of Elasticity - E: _____ ksi Coefficient of Restitution - e: _____						
	<b>Pile Cap</b>	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Helmet</td> <td rowspan="4" style="padding: 0 10px; vertical-align: middle;">Weight: _____</td> <td rowspan="4" style="padding: 0 10px; vertical-align: middle;">kips</td> </tr> <tr> <td style="padding: 2px;">Bonnet</td> </tr> <tr> <td style="padding: 2px;">Anvil Block</td> </tr> <tr> <td style="padding: 2px;">Drivehead</td> </tr> </table>	Helmet	Weight: _____	kips	Bonnet	Anvil Block	Drivehead
Helmet	Weight: _____	kips						
Bonnet								
Anvil Block								
Drivehead								
	<b>Pile Cushion</b>	Material: _____ Thickness: _____ in Area: _____ in <sup>2</sup> Modulus of Elasticity - E: _____ ksi Coefficient of Restitution - e: _____						
	<b>Pile</b>	Pile Type: _____ Length (In Leads): _____ ft Lb/ft.: _____ Taper: _____ Wall Thickness: _____ in Cross Sectional Area: _____ in <sup>2</sup> Design Pile Capacity: _____ kips Description of Splice: _____ _____ Tip Treatment Description: _____ _____						

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Resident Engineer

Note: If mandrel is used to drive the pile, attach separate manufacturer's detail sheet(s) including weight and dimensions.

Submitted By: \_\_\_\_\_

Date: \_\_\_\_\_ Phone No.: \_\_\_\_\_

**Add to section 49-2.01C(3):**

Drilling through the center of open-ended steel shells or steel pipe piles to attain the specified tip elevation may be necessary. The diameter of the drilled hole must be less than the inside diameter of the pile. Equipment or methods used for drilling holes must not cause quick soil conditions or cause scouring or caving of the hole. Drilling must not be used within 4 feet of the specified tip elevation. Do not drill before driving piles.

**Replace to section 49-2.01C(3) with:**

Before driving, you may drill holes with a diameter one inch less than the diameter of the piles at the locations and to the bottom of hole elevations shown in the following table:

Bridge no.	Abutment no.	Bent no.	Bottom of hole elevation
53C-2194 (North Firestone Blvd. Bridge)	1 and 4	--	46.0 ft
53-3044 (Coyote Creek Bridge)	1 and 4	--	46.0 ft

**Add to section 49-2.01C(4):**

Drive piles in predrilled holes at the locations and to the bottom of hole elevations shown in the following table:

Bridge name or number	Abutment no.	Bent no	Bottom of hole elevation
Br. no. 53-E0250 (RW TR3)			47.0 ft (5 piles shown)
Br. no. 53-3045 (Valley View Ave OH/OC (Replace))		4	48.0 ft
		5, 5A, 5B, 5C & 5D	50.0 ft

**Add to section 49-2.01C(5):**

Piles for North Firestone Blvd Bridge, Coyote Creek Bridge, that do not attain the nominal driving resistance at the specified tip elevation shown may be allowed to stand for a "set period" without driving. The "set period" must be at least 2 days.

After the "set period" has elapsed, redrive 2 piles or 10 percent of the piles in the footing, whichever is greater. The Engineer designates which piles are to be redriven. Redriving consists of operating the driving hammer at full rated energy on the pile and calculating the nominal driving resistance of the pile.

If the nominal driving resistance is attained for each pile designated to be redriven, the remaining piles in that footing are considered satisfactory and further driving will not be required. If redriving the designated piles demonstrates that the nominal driving resistance has not been attained, redrive all piles in the footing until the nominal driving resistance is attained.

**Replace "Reserved" in section 49-3.02A(4)(b) with:**

Schedule and hold a preconstruction meeting for CIDH concrete pile construction (1) at least 5 business days after submitting the pile installation plan and (2) at least 10 days before the start of CIDH concrete pile construction. You must provide a facility for the meeting.

The meeting must include the Engineer, your representatives, and any subcontractors involved in CIDH concrete pile construction.

The purpose of this meeting is to:

1. Establish contacts and communication protocol between you and your representatives, any subcontractors, and the Engineer
2. Review the construction process, acceptance testing, and anomaly mitigation of CIDH concrete piles

The Engineer will conduct the meeting. Be prepared to discuss the following:

1. Pile placement plan, dry and wet
2. Acceptance testing, including gamma-gamma logging, cross-hole sonic logging, and coring
3. *Pile Design Data Form*
4. Mitigation process
5. Timeline and critical path activities
6. Structural, geotechnical, and corrosion design requirements
7. Future meetings, if necessary, for pile mitigation and pile mitigation plan review
8. Safety requirements, including Cal/OSHA and Tunnel Safety Orders

**Add to section 49-3.02B(6)(c):**

The synthetic slurry must be one of the materials shown in the following table:

Material	Manufacturer
SlurryPro CDP	KB INTERNATIONAL LLC 735 BOARD ST STE 209 CHATTANOOGA TN 37402 (423) 266-6964
Super Mud	PDS CO INC 105 W SHARP ST EL DORADO AR 71731 (870) 863-5707
Shore Pac GCV	CETCO CONSTRUCTION DRILLING PRODUCTS 2870 FORBS AVE HOFFMAN ESTATES IL 60192 (800) 527-9948
Terragel or Novagel Polymer	GEO-TECH SERVICES LLC 220 N. ZAPATA HWY STE 11A-449A LAREDO TX 78043 (210) 259-6386

Use synthetic slurries in compliance with the manufacturer's instructions. Synthetic slurries shown in the above table may not be appropriate for a given job site.

Synthetic slurries must comply with the Department's requirements for synthetic slurries to be included in the above table. The requirements are available from the Offices of Structure Design, P.O. Box 168041, MS# 9-4/11G, Sacramento, CA 95816-8041.

SlurryPro CDP synthetic slurry must comply with the requirements shown in the following table:

### SLURRYPRO CDP

Property	Test	Value
Density During drilling	Mud Weight (density), API 13B-1, section 1	$\leq 67.0 \text{ pcf}^a$
Before final cleaning and immediately before placing concrete		$\leq 64.0 \text{ pcf}^a$
Viscosity During drilling	Marsh Funnel and Cup. API 13B-1, section 2.2	50–120 sec/qt
Before final cleaning and immediately before placing concrete		$\leq 70 \text{ sec/qt}$
pH	Glass electrode pH meter or pH paper	6.0–11.5
Sand content, percent by volume Before final cleaning and immediately before placing concrete	Sand, API 13B-1, section 5	$\leq 0.5 \text{ percent}$

<sup>a</sup>If authorized, you may use slurry in salt water. The allowable density of slurry in salt water may be increased by 2 pcf.

Slurry temperature must be at least 40 degrees F when tested.

Super Mud synthetic slurry must comply with the requirements shown in the following table:

### SUPER MUD

Property	Test	Value
Density During drilling	Mud Weight (Density), API 13B-1, section 1	$\leq 64.0 \text{ pcf}^a$
Before final cleaning and immediately before placing concrete		$\leq 64.0 \text{ pcf}^a$
Viscosity During drilling	Marsh Funnel and Cup. API 13B-1, section 2.2	32–60 sec/qt
Before final cleaning and immediately before placing concrete		$\leq 60 \text{ sec/qt}$
pH	Glass electrode pH meter or pH paper	8.0–10.0
Sand content, percent by volume Before final cleaning and immediately before placing concrete	Sand, API 13B-1, section 5	$\leq 0.5 \text{ percent}$

<sup>a</sup>If authorized, you may use slurry in salt water. The allowable density of slurry in salt water may be increased by 2 pcf.

Slurry temperature must be at least 40 degrees F when tested.





**Add to section 51-1.01C(1):**

If the methacrylate crack treatment is performed within 100 feet of a residence, business, or public space, submit a public safety plan that includes the following:

1. Public notification letter with a list of delivery and posting addresses. The letter must describe the work to be performed and state the treatment work locations, dates, and times. Deliver the letter to residences and businesses within 100 feet of overlay work and to local fire and police officials not less than 7 days before starting overlay activities. Post the letter at the job site.
2. Airborne emissions monitoring plan. A CIH certified in comprehensive practice by the American Board of Industrial Hygiene must prepare and execute the plan. The plan must have at least 4 monitoring points including the mixing point, application point, and point of nearest public contact. Monitor airborne emissions during overlay activities.
3. Action plan for protecting the public if levels of airborne emissions exceed permissible levels.
4. Copy of the CIH's certification.

After completing methacrylate crack treatment activities, submit results from monitoring production airborne emissions as an informational submittal.

**Replace the 2nd paragraph of section 51-1.01C(1) with:**

Submit a deck placement plan for concrete bridge decks. Include in the placement plan your method and equipment for ensuring that the concrete bridge deck is kept damp by misting immediately after finishing the concrete surface.

**Add to section 51-1.01C:**

**51-1.01C(6) Architectural Treatment**

Submit 3 sets of shop drawings for mock-up panels. Include in the submittal:

1. Details of the mock-up shown including details for adjoining liners.
2. Design and details of a vertical support system for the mock-up panels to be reviewed in the same angle as they are on the abutment, barrier, and walls.

**Add to section 51-1.01D(3):**

Construct 1 additional test panel to demonstrate the method of repairing defects in the texture as follows:

1. Damage the surface of the test panel to impose a defect
2. Photograph the defected area and submit an electronic copy
3. Repair the defect to a condition acceptable to the Engineer

The repaired test panels must be retained and used along with the full-size mock-up panels as the standard of comparison in determining the acceptability of repaired surfaces.

**Replace the 2nd paragraph of section 51-1.01D(3):**

The Engineer may request that additional test panels be constructed until the specified finish, texture, form, shape, and color are attained and authorized by the engineer.

**Add to section 51-1.01D:**

**51-1.01D(6) Mock-Up Panels**

Do not construct mock-up panels until all the test panels have been authorized.

Mock-up panels must:

1. Be constructed at an authorized location.
2. Have the size, various textures and patterns shown.
3. Be constructed and finished using the personnel, materials, equipment, and methods to be used in the work.

4. Include all the form liner edge conditions to be encountered in the final construction. This includes the interface edge between the form finish transverse and longitudinal form liner panel edges, the form finish texture edges, and joint conditions.
5. Have no visible edge variation.
6. Be authorized before starting work.

The Engineer may request that additional mock-up panels be constructed until the specified form, shape, finish, texture, and color are attained and authorized by the Engineer.

The Engineer uses the authorized mock-up panels and repaired test panels to determine acceptability of the work.

#### **51-1.01D(7) Test Section**

Test sections for concrete barrier Type 60G must be:

1. Constructed at an authorized location
2. At least 9 feet by 3 feet by 3 inches deep
3. Constructed and finished using the personnel, materials, equipment, and methods to be used in the work
4. Authorized before starting work

The Engineer may request that additional test section be constructed until the specified form, shape, finish, texture, and color are attained and accepted by the Engineer in writing.

The Engineer uses the authorized test section to determine acceptability of the work.

#### **Add to section 51-1.02B:**

Concrete for concrete bridge decks must contain polymer fibers. Each cubic yard of concrete must contain at least 1 pound of microfibers and at least 3 pounds of macrofibers.

Concrete for concrete bridge decks must contain a shrinkage reducing chemical admixture. Each cubic yard of concrete must contain at least 3/4 gallon of a shrinkage reducing admixture. If you use the maximum dosage rate shown on the Authorized Material List for the shrinkage reducing admixture, your submitted shrinkage test data does not need to meet the shrinkage limitation specified.

#### **Replace the 1st paragraph in section 51-1.03F(5)(b)(i) with:**

Texture the bridge deck surfaces longitudinally by grinding and grooving.

#### **Add to section 51-1.03G(1):**

Split slate texture must be an architectural texture simulating the appearance of natural split slate.

Fluted rib texture must be an architectural texture simulating the appearance of fluted rib.

Fractured granite texture must be a concrete surface texture simulating the appearance of fractured granite.

Split face running bond texture must be a masonry surface texture simulating the appearance of natural split face.

Architectural treatment on concrete barrier Type 60G must include a scallop pattern with light and heavy fractured granite texture finish applied to both side of the barrier. Light fractured granite texture must consist of blast removal of surface skin of cement and sand to expose the surface of the coarse aggregate. Heavy fractured granite must consist of blast removal of cement and fine aggregate to a depth where coarse aggregate becomes the dominant surface feature.

Construct a mock-up panel for each location shown.

Construct a test section for Type 60G concrete barrier

**Add to section 51-1.03G(2):**

No substitution of other types of form liner material is allowed.

Recurring textural configuration exhibited by repeating patterns or recognizable shadow patterns must be prevented by proper casting of form liner patterns to include rotating form liner panels and/or using more than one form liner panel.

Textured concrete surface with such recurring textural configurations must be reworked to remove such patterns as authorized by the Engineer.

**Replace the 2nd paragraph of section 51-1.03H with:**

Cure the top surface of bridge decks by (1) misting and (2) the water method under section 90-1.03B(2). After strike off, immediately and continuously mist the deck with an atomizing nozzle that forms a mist and not a spray. Continue misting until the curing medium has been placed and the application of water for the water method has started. At the end of the curing period, remove the curing medium and apply curing compound on the top surface of the bridge deck during the same work shift under section 90-1.03B(3). The curing compound must be curing compound no. 1.

**Add to section 51-1.04:**

Payment for architectural texture treatment on the concrete barriers is included in the payment for concrete barriers involved.

Payment for architectural texture treatment on the concrete closure wall is included in the payment for concrete closure wall.

**Replace "Reserved" in section 51-3.03 with:**

**51-3.03A General**

**51-3.03A(1) Summary**

Section 51-3.03 includes specifications for fabricating and installing PTFE spherical bearings.

PTFE spherical bearings consist of PTFE and stainless steel bearing surfaces, stainless steel plates, and anchors. PTFE spherical bearings are either (1) fixed type with spherical bearing surfaces or (2) expansion type with spherical and sliding bearing surfaces.

**51-3.03A(2) Definitions**

**load category:** PTFE spherical bearings of differing vertical load capacity within a range defined as follows:

1. Bearings of 500 kips capacity or less
2. Bearings over 500 kips up to and including 2,000 kips capacity
3. Bearings over 2,000 kips capacity

Bearings in 2 different load categories that have vertical load capacities within 180 kips of each other are considered to be in 1 load category for proof testing.

**51-3.03A(3) Submittals**

**51-3.03A(3)(a) General**

Submit proof that the bearing manufacturer has furnished PTFE spherical bearings that have had at least 3 years of satisfactory service for 2 projects with similar conditions to this project.

Submit certificates of compliance for the materials used in PTFE bearings.

Submit test reports for proof-tested bearings signed by the personnel conducting the testing. Include bearing numbers of the tested bearings and the names of the personnel interpreting the test results. If proof tests cannot be performed at the specified load, submit a testing plan listing additional physical tests to be performed.

### **51-3.03A(3)(b) Shop Drawings**

Submit shop drawings to OSD, Documents Unit. Notify the Engineer of your submittal. Include in the notification the date and contents of the submittal.

For initial review, submit 6 copies for railroad bridges and 4 copies for other structures. After review, submit 6 to 12 copies, as requested, for authorization and use during construction. Allow 55 days for the Department's review for railway bridges and at least 45 days for all other structures.

Shop drawings must include a description of the method of mechanical interlocking of PTFE fabric to the metallic substrate.

At locations other than hinges, shop drawings must include temporary support details for the bearing sole plate during concrete placement.

### **51-3.03A(4) Quality Control and Assurance**

#### **51-3.03A(4)(a) General**

A qualified representative of the bearing manufacturer must be present during installation of the 1st bearing and be available during remaining installations.

Templates for the spherical surfaces must be available for inspection.

#### **51-3.03A(4)(b) Proof Testing**

Proof test the PTFE spherical bearings in the Engineer's presence as follows:

1. Test fixed-type bearings for compression.
2. Test expansion-type bearings for compression and initial static coefficient of friction.

Proof test 1 bearing from each lot of production bearings. A lot of bearings is 25 bearings, or fraction thereof, of the same type within a load category.

The Engineer selects random test samples from each lot of production bearings. Notify the Engineer at least 7 days before starting proof testing.

If proof tests cannot be performed at the specified load, perform the additional physical tests listed in the testing plan in the presence of the Engineer. The tests must demonstrate that the requirements for proof testing at the specified load are satisfied.

Before proof testing, the test bearings must be conditioned for 12 hours at  $75 \pm 5$  degrees F. Clean the bearing surfaces before testing.

For compression testing of PTFE spherical bearings:

1. Rotate the bearings at the design rotation or 0.02 radians, whichever is greater, and hold for 1 hour at a load of 1.5 times the maximum vertical load capacity. You may rotate the bearing by inserting a beveled plate between the bearing and the restraining surface before loading.
2. Maintain the bearing in a rotated position during testing.

For coefficient of friction testing of PTFE spherical bearings:

1. Continuously load the bearing to the minimum dead load for 12 hours before testing. Maintain the dead load during testing.
2. Measure the initial static coefficient of friction on the 1st movement of the bearing.
3. Measure the initial static and dynamic coefficients of friction at a sliding speed of not more than 1 inch per minute. The initial static friction must not exceed that specified.
4. Cycle the test bearings for a minimum of 100 movements. Each movement must consist of at least 1 inch of relative movement at a sliding speed of not more than 12 inches per minute. After cycling, measure the initial static and dynamic coefficients of friction at a sliding speed of not more than 1 inch per minute. The initial static friction must not exceed that specified.

Proof-tested bearings must not show any signs of the following:

1. Bond failure of bearing surfaces
2. Separation or lift-off of plates from each other or from PTFE surfaces
3. Excessive transfer of PTFE to the stainless steel surface
4. Other defects

If a proof-tested bearing fails to comply with the above requirements, proof test all the remaining bearings in the lot.

### **51-3.03B Materials**

#### **51-3.03B(1) General**

Welding must comply with AWS D1.1 except welding of stainless steel must comply with AWS D1.6.

PTFE spherical bearings must be self-lubricating.

PTFE surfaces must be unfilled fabric made from virgin PTFE oriented multifilament and other fibers. Filament resin must comply with ASTM D 4441.

At the highest point of substrate and after compression, the PTFE fabric must have a thickness from 1/16 to 1/8 inch.

Steel plates must comply with ASTM A 709/A 709M.

Stainless steel plates must comply with ASTM A 240, Type 304, and be at least 1/8 inch thick.

Surfaces of flat stainless steel that mate with PTFE surfacing must have a minimum no. 8 mirror finish. Surfaces of curved stainless steel that mate with PTFE surfacing must have a finish of less than 16 microinches root mean square. Determine the finish under ANSI B46.1.

PTFE spherical bearings must have an initial static coefficient of friction of at most 0.06.

Stud connectors must comply with section 55-1.02.

#### **51-3.03B(2) Fabrication**

Flat stainless steel surfaces must be a weld overlay on structural steel plate or a solid or sheet stainless steel.

Curved stainless steel surfaces must be solid stainless steel except curved stainless steel surfaces over 6 inches thick may be a weld overlay on structural steel plate.

When a weld overlay is used for stainless steel surfacing, attach the overlay by submerged arc welding using Type 309L electrodes. The completed overlay must have a 3/32-inch minimum thickness after fabrication.

When stainless steel sheets are used for stainless steel surfacing, attach the sheets by perimeter arc welding using Type 309L electrodes. After welding, the stainless steel surface must be smooth and without waves.

Plate radius dimensional tolerances are from 0.000 to -0.010 inch for convex plates and from +0.010 to 0.000 inch for concave plates.

Use a full-size convex and concave metal templates for the spherical surfaces of each bearing radius.

PTFE fabric backing material on bearing surfaces must be epoxy bonded and mechanically interlocked to the steel substrate. Bonding must be performed under controlled factory conditions. The mechanical interlock on the spherical concave surface must be integrally machined into the steel substrate. Welded retention grids are not allowed on the concave surface. Except for the selvage, oversaw or recess edges such that no cut fabric edges are exposed.

During fabrication, the maximum temperature of bonded PTFE surfaces must be 300 degrees F.

After bonding to the substrate, the PTFE surface must be smooth and free from bubbles.





At least 5 days before placing Class 4 permeable material, submit a certificate of compliance for gradation of the material.

No more than 5 days after placing Class 4 permeable material, submit:

1. At least one ASTM D 6913 test on the permeable material at an authorized location.
2. Verification that the placed permeable material complies with the grading requirements

Prior to placement, wash Class 4 permeable material:

1. To remove silt and clay particles.
2. With potable water equal to at least four times the volume of the material to be placed.

After placement, wash Class 4 permeable material:

1. With potable water.
2. Until the discharged water has a turbidity reading of:
  - a. 30 NTU or less for jobs within the Tahoe Hydrologic Unit
  - b. 200 NTU or less for jobs outside of the Tahoe Hydrologic Unit

You must capture and dispose of the wash water, and

1. Dispose of outside the state right of way.
2. Use as dust control.
3. Disperse onsite in an authorized location other than the BMP.

**Add to section 68-2.02F:**

**68-2.02F(6) Class 5 Permeable Material**

Class 5 permeable material for use in media filters must consist of hard, durable, clean sand, and must be free from organic material, clay balls, or other deleterious substances.

The percentage composition by weight of Class 5 permeable material in place must comply with the grading requirements shown in the following table:

**Class 5 Permeable Material  
Grading Requirements**

Sieve sizes	Percentage passing
3/8"	100
No. 4	95-100
No. 8	80-100
No. 16	45-85
No. 30	15-60
No. 50	3-15
No. 100	0-4
No. 200	0

Standard ASTM	Range
6913	
Effective Particle size (ES)=(D <sub>10</sub> )	0.0098"-0.0197"
Uniformity Coefficient U <sub>c</sub> = (D <sub>60</sub> /D <sub>10</sub> )	< 4



The drainage gate cover must be hinged from the flat-back seat by 2 supporting links with 1 on each side of the gate. The links must be pivotally connected at the top of the seat and at the bottom to the cover above the center of gravity. Bushings of suitable length and diameter must be provided at the 4 hinge points.

Drainage gates must be assembled in the shop. Shop coat cast iron parts with commercial quality asphaltic paint furnished.

The cover of the installed drainage gate must fit tight against the seat when there is no pressure on the cover face.

The cover must be equipped with an eye bolt at the bottom for opening the gate under pressure.

**Replace section 70-6 with:  
70-6 GRATED LINE DRAINS**

**70-6.01 GENERAL**

Section 70-6 includes specifications for constructing grated line drains.

Submit a certificate of compliance from the manufacturer.

**70-6.02 MATERIALS**

**70-6.02A General**

Concrete backfill must comply with the specifications for minor concrete.

**70-6.02A Line Drain Channel**

Drain channel sections must be manufactured using monolithic polymer concrete with no side extensions. The interior surface of the line drain channel must be smooth below the level of the frame, grate, and associated connections.

Monolithic polymer concrete must consist of aggregate with either polyester resin or vinylester resin. The polymer concrete must have the values and properties shown in the following table:

Property	ASTM Test method	Value
Tensile strength, psi	C 307	1,450 min
Compressive strength, psi	C 579	11,600 min
Bending strength, psi	C 580	2,900 min
Moisture absorption, percentage	C 140	0.5 max
Chemical resistance	C 267	Pass
Freeze-thaw, number of cycles with out weight loss	C 666	1,600 min

**70-6.02B Line Drain Frames and Grates**

Frames and grates must be heavy duty rated under General Services Administration CID A-A-60005 *Frames, Covers, Gratings, Steps, Manholes, Sump and Catch Basin*. The design and performance requirements include the following:

1. Grated line drain frames and grates must be manufactured of ductile iron complying with section 75-1.02. Frames and grates include bolts, nuts, frame anchors, and other connecting hardware. Galvanizing or asphalt paint coating is not required.
2. Frames and grates, whether one-piece or separate, must be classified heavy duty traffic rated with a transverse proof-load strength of 25,000 pounds
3. Grates and frames must be one piece anchored into the body of the line drain unless shown as removable. Removable grates must be separate from the frame and must:
  - 3.1. Be held in place by locking devices that are tamper resistant
  - 3.2. Provide a minimum repetitive pullout resistance of 340 lb/ft of length after completion of 1,000 hours of salt spray testing under ASTM B 117

- 3.3. Be match marked in pairs before delivery to the work and grates must fit into the frames without rocking
4. If a combination of one piece frame and grate and removable grates are used, the locations of the removable grates are shown
5. Except for grates installed within designated pedestrian paths of travel, grate design must accept inflow of runoff through openings consisting of a minimum of 60 percent of the total top surface area of the grate. Individual openings or slots must have a dimension not greater than 2 inches measured in the direction of the grated line drain flow line.
6. Grates installed within designated pedestrian paths of travel must be certified as conforming to the requirements of the Americans with Disabilities Act.

### **70-6.03 CONSTRUCTION**

Excavation and backfill must comply with section 19-3.

Grated line drains must be installed in trenches excavated to the lines and grades established by the Engineer. Grade and prepare the bottom of the trench to provide a firm and uniform bearing throughout the entire length of the grated line drain.

Installation of grated line drains and joints must comply with the manufacturer's instructions.

Install to the lines and grades with sections closely jointed and secured to ensure that no separation of the line drains occurs during backfilling.

The frame or grate must not extend above the level of the surrounding concrete backfill.

Connect grated line drains to new or existing drainage facilities as shown.

Backfill with minor concrete.

Place concrete backfill in the trench as shown. Place against undisturbed material at the sides and bottom of the trench in a manner that prevents (1) floating or shifting of the grated line drain and voids or (2) segregation in the concrete.

Immediately remove foreign material that falls into the trench before or during placement of the concrete.

Where necessary construct and compact earth plugs at the ends of the concrete backfill to contain the concrete within the trench.

Secure frames or line drain wall to the surrounding concrete backfill with steel anchoring rods as shown. Alternative securing methods must provide a minimum pullout resistance of 685 lb/ft of length of grated line drain frame.

Concrete backfill must be finished flush with the adjacent surfacing.

The surface of the concrete must be textured with a broom or burlap drag to produce a durable skid-resistant surface.

### **70-6.04 PAYMENT**

Payment for frames and grates is included in the payment for grated line drain.

## **Add section 70-8 with: 70-8 TEMPORARY DRAINAGE**

### **70-8.01 GENERAL**

You must monitor the National Weather Service's forecast on a daily basis. An alternative weather forecast may be used if approved by the Engineer.

Provide a temporary drainage system the end of each day when drainage systems are not functional unless fair weather is predicted through the following working day.





### **77-1.01C Submittals**

Submit a complete set of as-built drawings within 30 days of installation. As-built drawings must be 11 by 17 inches in size and on 20 pound paper. Text must be a minimum nominal height of 5/32 inch.

### **77-1.02 MATERIALS**

Not Used

### **77-1.03 CONSTRUCTION**

Not Used

### **77-1.04 PAYMENT**

Not Used

## **77-2 SEWER**

### **77-2.01 GENERAL**

#### **77-2.01A General**

##### **77-2.01A(1) Summary**

Section 77-2 includes specifications for performing sewer work.

Sewer work includes installing:

1. 8 through 24 inch VCP sewer pipe
  - 1.1 temporary bypass sewer system
  - 1.2 CCTV inspection
2. Ductile iron pipe
3. Sewer manhole frame and cover
4. Concrete sewer manhole

No work must begin on sewer line construction until:

1. The working drawings, flow by-pass, and emergency spill response plans have been authorized.
2. All segments of the sewer lines have been video inspected to verify lateral locations to remaining functional properties.

Design, install, maintain, and remove temporary bypass sewer systems. Two separate above-ground flow bypass systems are required. Flow bypass system no. 1 is required from manhole F232 at station 12 + 20.77 to manhole F230 at station 195 + 79.19. Flow bypass system no. 2 is required from temporary manhole at station 12 + 28 to manhole F231 at station 10 + 00. Each flow bypass system must be designed to convey a peak flow of 4 cubic feet per second. The temporary bypass sewer systems must provide continuous functionality and operation of the sewer systems during construction until no longer required. Fully-redundant backup systems must be provided in case of failure of the primary system. Flow bypass is not permitted without a 5 day clear weather forecast or within 2 days after a rain event.

Sewer laterals from functional properties must be referenced to the nearest new sewer manhole and redlined on contract plans.

The LACSD representative must be present when performing work on the 24 inch diameter sewer trunk.

Trenchless culvert for sewer pipe must comply with section 78-2.

##### **77-2.01A(2) Definitions**

Not Used

##### **77-2.01A(3) Submittals**

###### **77-2.01A(3)(a) General**

Submit working drawings as specified in Section 2-5.3 of the SSPWC. Working drawings must be signed by a Civil or Structural Engineer registered in the State. Working drawings must include the sequence of work performed. Sequencing should be followed according to the information handout.

Submit signed shoring plans that comply with Section 7-1.02K(6).

Approvals and instructions from the LACSD, LACDPW, City of Santa Fe Springs, the City of La Mirada, the City of Buena Park, and the City of Cerritos personnel will be transmitted to you by the Engineer.

Submit a list of materials, equipment, and manufacturer's descriptive data.

Manufacturer's descriptive data must include complete descriptions, performance data and installation instructions for materials and equipment specified.

Leakage test results must be signed by your supervisor who performed testing work.

Expansion joint submittal must include a leak-proof certificate and expansion joint's preset dimensions for installation.

Submit a copy of the redlined referenced sewer lateral contract plans to the Los Angeles County of Public Works Engineer and a copy to the Engineer.

If polypropylene steps are installed, submit a certificate of compliance prepared by an independent certified laboratory.

Sewer video of all segments must be submitted before partial field acceptance, 95 percent, and completed field acceptance, 98 percent. Provide 2 copies of complete DVD digital media formatted CCTV inspection to Engineer before contract acceptance.

Right-of-way map and as-built sewer plans must be submitted before partial field acceptance.

#### **77-2.01A(3)(b) Sewage Spill Response**

Call the LACSD 24 hour emergency notification number at (310) 638-1161 and act immediately to control a sewage spill. Take all appropriate steps to contain it according to the sewage spill response plan and flow bypass plan. Immediately notify the Engineer and LACSD and report project name, location, Contractor name, Project Engineer and Resident Engineer's names.

The Engineer may institute further corrective actions to fully comply with existing laws, ordinances, codes, orders or other pertinent regulations. You are responsible for all costs incurred for the corrective action including mitigation measures or habitat restoration, and obtaining after-the-fact permits if necessary, in any environmentally sensitive area. These permits include those from the City of National City, California Coastal Commission, U. S. Army Corps of Engineers, the California Department of Fish and Game, and all relevant agencies.

You are responsible for paying any fines assessed from a sewage spill.

Within 5 days from spill occurrence, submit a report to the agency and a copy to the Engineer as an informational submittal describing the following information:

1. Location of the spill
2. Nature and estimated volume
3. Date and time
4. Duration
5. Cause
6. Type of remedial efforts or clean up measures taken, including erosion control measures
7. Date and time of implementation
8. Corrective or preventive actions taken to avoid further spills
9. Equipment used in spill response
10. Environmentally-sensitive habitat, if any, impacted
11. Results of any necessary monitoring
12. List of who was notified at the City, date and time you were notified of the spill, date and time you arrived on site

#### **77-2.01A(3)(b) Flow Bypass Plan**

Submit to the County Sanitation District for approval before submitting to the Engineer, a flow bypass plan (FBP). The plan must comply with the LACSD amendments to section 500-1.1.7(f) of the SSPWC, 2012 edition.

The flow bypass plan must indicate the sequence of diversion operations and other activities that will maintain wastewater service during construction. Include an emergency response plan indicating the procedures, equipment, and activities to be implemented if an emergency shutdown or failure of the flow diversion equipment occurs.

**77-2.01A(3)(b) Emergency Spill Response Plan**

Submit an emergency spill response plan (ESRP). The plan must comply with the LACSD amendments to section 500-1.1.7(f) of the SSPWC, 2012 edition.

Develop an emergency notification procedure, which includes an emergency response team with telephone numbers and arrangements for backup personnel and equipment. The emergency response unit must be able to dispatch to the site 24 hours a day 7 days a week. Designate primary and secondary representatives, their respective phone numbers, pager numbers, and mobile phone numbers. These representatives must be accessible and available at all times to respond immediately to any sewer spill event.

Identify any property owners who may be affected.

**77-2.01A(4) Quality Control and Assurance**

CCTV inspection of LACDPW sewer systems must comply with CCTV Inspection, Guidelines for Acceptance of Sewers, November 2008 edition.

Each bypass system must be tested with potable water.

**77-2.01A(5) Notifications**

Notify LACSD at (310) 830-8050 at least 10 days before beginning trunk line sewer and related work.

Notify Martha Tremblay, wastewater collection system manager for the county sanitation districts at 1 (310) 638-1161 at least 5 days before the start of flow bypass.

Notify applicable local agencies at least 10 days before beginning work on the sewer system including:

1. City of La Mirada, Public Works Engineer at (562) 902-2385
2. City of Santa Fe Springs, Public Works Engineer at (562) 868-0511 ext 7540
3. City of Buena Park, Public Works Engineer at (714) 562-3670
4. City of Cerritos, Public Works Engineer at (562) 916-1220
5. Los Angeles County Department of Public Works Engineer at (626) 458-3130

Notify LACSD field engineering manager, at (310) 830-8050 at least 5 business days before commencing the abandonment of the manhole and at least 5 business days before the start of any work involving LACSD manholes and request inspection

**77-2.01B Materials**

Material must comply with Part 2 of the SSPWC and LACSD amendments to SSPWC, 2012 edition.

Concrete bedding and encasement for house connection remodeling must be class 420-C-200.

Concrete backfill around sewer manholes must be a cement-sand slurry containing 141 pounds of cementitious material per cubic yard.

All concrete must be 660-B-4000 and all reinforcing bars must be deformed bars conforming to ASTM A706 Grade 60 for LACSD manholes.

Precast concrete for temporary manhole must comply with standard plan 200-3 of SPPWC, 2012 edition.

Precast concrete shallow manhole must:

1. Be designed to develop 25 Mpa (3500 psi) or greater strength in 28 days.
2. Be reinforced for H-20 bridge loading.
3. Field placed concrete must be Class 310-C-17 (520-C-2500) and allowed to set 24 hours before placing precast units.
4. Cement mortar must be Class D per section 201-5.1 of SSPWC 2012 edition

Steps must be steel, stainless steel or steel reinforced copolymer polypropylene plastic.

Steel steps must comply with ASTM A307 and be galvanized after fabrication.

Stainless steel steps must comply with ASTM A276, 300 series.

Steel reinforced copolymer polypropylene plastic steps must comply with SPPWC 636 and one of the following:

1. ASTM D478 and C497, Except that the minimum horizontal pullout load must be 1,500 lbs
2. ASTM A615 Grade 60 deformed reinforcing steel bar
3. CA Code of Regs, Title 8, General Industry Safety Orders.

Steps must be capable of withstanding an impact load of 70 foot-lbs at 20 degree F without cracking or fracturing.

The minimum total cross-sectional area of the exposed portion of the step, including the deformed steel bar and excluding the non-slip tread surface, must be 1.0 square inch.

Rectangular shallow manhole concrete must be class 295-C-17 (500-C-2500)

The entire polypropylene plastic material surround the reinforcing steel bar must be cast monolithically, minimum cover must be 3/16 inch.

Cement mortar for trap manhole base must be class D per section 201-5.1 of SSPWC, 2012 edition.

#### **77-2.01C Construction**

##### **77-2.01C(1) General**

Remove and dispose of sewage and sediment from sewage facilities before removing or abandoning.

Excavation and backfill must comply with section 19-3.

Concrete encasement must be installed as shown.

Cement-slurry backfill must extend to the undisturbed native soil or if placed against compacted backfill material, must extend at least 2 feet beyond the manhole outside wall.

Partially form the base of the manhole around the existing 24 inch RCP and construct the temporary manhole. When directed, carefully saw-cut the top half of the 24 inch RCP inside manhole and set it aside. Above-ground flow bypass must be provided until no longer required. At the conclusion of flow bypass, demolish and remove temporary manhole and reinstall and secure the top half of the 24 inch RCP.

Concrete for all precast units must be compactly vibrated in the forms. Cure according to approved practice either by steam, sprinkling, membrane solution or a combination of these.

Sanitary sewer work must comply with Part 3, Sections 303 and 306 of the SSPWC, 2012 Edition, LACSD amendments to Sections 303 and 306 of the SSPWC, unless otherwise specified. The payment sections in Section 303 and 306 of the SSPWC do not apply.

Perform CCTV inspection under section 15.6.01A(4)(d) and with SSPWC section 500-1.1.5

Perform CCTV inspection after the sewer line has been installed, backfilled, and compacted, but before final paving.

Repair structural cracking, correct excessively deflected joints, sags, remove protruding joint sealing material, corrosion, and other defects revealed by the CCTV inspection.

Inspect reworked areas with CCTV and submit results.

Copies of the LACSD amendments to SSPWC, 2012 edition, may be obtained at:

[http://www.lacsd.org/info/bid\\_information/construction\\_projects/amendments.asp](http://www.lacsd.org/info/bid_information/construction_projects/amendments.asp)

### **77-2.01C(2) Flow Bypass**

Inspect and maintain the flow bypass system daily, including the back-up system. Maintain a log of all inspection, maintenance and repair records and provide copies to the Engineer upon request.

Provide personnel with no other duties other than monitoring and maintaining the flow bypass system.

Maintain a log of the monitoring and provide daily copies to the Engineer.

If the flow bypass system requires pumping, each pump, including the backup pumps, must be a complete unit with its own suction and discharge piping. Operate the backup flow bypass system for a minimum of 25 percent of the total diversion time on a weekly basis. The backup flow bypass system must be fully installed, operational, and ready for immediate use. Demonstrate to the Engineer that both the primary and backup flow diversion systems are fully functional and adequate, and certify the same, in writing.

Provide 1 dedicated fuel tank for every single pump/generator, when fuel/generator driven pumps are used. Provide an emergency standby power generator, when electric power driven pumps are used. Provide a fuel level indicator outside each fuel tank. Continuously monitor while in use, the fuel level in the tanks and ensure that the fuel level does not drop below a level equivalent of 2 hours of continuous flow diversion system operation. Protect the fuel supply from contamination. This includes fuel line water traps, fuel line filters, and protecting fuel stores from precipitation. Monitor all hoses and repair leaks immediately.

### **77-2.01D Payment**

Not Used

## **77-2.02 ABANDON SEWER AND SEWER MANHOLE**

### **77-2.02A General**

Section 72-2.02 includes specifications for abandoning portions of sewer system, constructing concrete plugs, pipe removal, structural excavation, fill and backfill including sand, controlled low strength material or slurry cement fill or backfill, in accordance with the details shown.

### **77-2.02B Materials**

Not Used

### **77-2.02C Construction**

Abandoned sewer pipe greater than 12 inches must be filled with 7 sack cement sand slurry.

### **77-2.02D Payment**

The length to be paid will be the length of pipe abandoned measured along the pipe centerline between the inside faces of structures.

## **77-2.03 REMOVE SEWER AND MANHOLE**

### **77-2.03A General**

Section 77-2.03 includes specifications for removing sanitary sewer pipe, manholes and concrete pipe encasement and backfilling resulting openings.

The length of pipe to be paid will be the length of pipe removed measured along the pipe centerline between the inside faces of structures.

### **77-2.03B Materials**

Not Used

### **77-2.03C Construction**

Sewer pipes and manholes must be completely removed if any portion of these structures is within 3 feet of the grading plane in excavation areas or within 1 foot of original ground in embankment areas.

Remove sewer pipe flush with exterior manhole wall.

Portland cement concrete component removal must comply with section 15-3.

**77-2.03D Payment**

Not Used

**77-2.04 ADJUST SEWER MANHOLE****77-2.04A General****77-2.04A(1) Summary**

Section 77-2.04 includes lowering or raising sewer manhole frames and covers.

**77-2.04A(2) Notifications**

Notify the Los Angeles County Sanitation District Superintendent of Maintenance at (310) 638-1161 not less than 5 business days before the start of any work involving LACSD manholes and request inspection.

**77-2.04B Materials**

Mortar for concrete ring and leveling must comply with 51-1.02F.

**77-2.04C Construction**

Lower or raise frames and covers of existing sewer facilities after placing hot mix asphalt surfacing. Temporarily fill utility depressions with HMA (Type A) before opening the lane to public traffic.

If the grade over the manhole is lowered:

1. Place a temporary steel cover plate of adequate thickness and size approved by the LACSD for the manhole.
2. Excavate around the manhole to a depth and distance outside the manhole as required to remove the manhole frame and cover.
3. Remove the manhole frame and cover and the interfering portion of the manhole shaft and place the cover plate over the manhole.
4. Store and protect the frame and cover and fill or pave over the cover plate to the final grade.
5. Remove fill or pavement and raise the manhole to final grade. Remove fill or pavement not less than 6 inches below the final grade and 12 inches around the manhole if the cover plate is more than 6 inches below final grade.
6. Raise the manhole and set the frame and cover to final grade.
7. Backfill and compact the pavement around the manhole.

If the grade over the manhole is raised:

1. Fill or pave directly over the frame and cover to final grade.
2. Remove fill or pavement and raise the manhole to final grade. Remove fill or pavement not less than 6 inches below the final grade and 12 inches around the manhole if the cover plate is more than 6 inches below final grade.
3. Raise the manhole and set the frame and cover to final grade.
4. Backfill and compact the pavement around the manhole.

**77-2.04D Payment**

Not Used

**77-3 WATER****77-3.01 GENERAL****77-3.01A Summary**

Section 77-3 includes general specifications for constructing water system work owned by the City of Santa Fe Springs.

**77-3.01B MATERIALS**

Not Used

**77-3.01C CONSTRUCTION**

Not Used

### **77-3.01D PAYMENT**

Not Used

### **77-3.02 WATER DISTRIBUTION**

#### **77-3.02A General**

##### **77-3.02A(1) Summary**

Section 77-3 includes specifications for constructing water distribution facilities owned by the City of Santa Fe Springs.

This work includes installing:

1. Cement lined ductile iron pipe including concrete collars and reinforcement
2. Pipeline connections including elbows, wyes, tees, tee connections, other branches, fittings, and coupling systems
3. Gate valve and box
4. Fire hydrant
5. Air vacuum and air release assembly
6. Blow off valve assembly
7. Copper service assembly
8. Backflow preventer assembly

The City of Santa Fe Springs Water Division will operate all existing water valves.

All water must be measured through a City of Santa Fe Springs approved meter.

##### **77-3.02A(2) Submittals**

###### **77-3.02A(2)(a) General**

Submit certified mill tests for all reinforcing steel.

Submit a certificate of compliance for pipe and resilient-seated gate valve.

Submit shoring calculations and plans. Shoring must be signed and sealed by a Civil Engineer registered in the State.

###### **77-3.02A(2)(b) Manufacturer's Descriptive Data**

Manufacturer's descriptive data must include complete description, performance data, and installation instructions for the materials and equipment described.

Submit manufacturer's descriptive data for the following material:

1. Backflow preventer assembly
2. Fire hydrant
3. Valve box
4. Meter box
5. Saddles
6. Tracer wire
7. Ball Valve
7. Gate valve
8. Air vacuum and air release valves
9. Pipe material
10. Pipe fittings including bends, tees, reducers, caps, struts, flanges, stub outs, blow-off assembly, and couplings
11. Pipe appurtenances including marking tape, polyethylene wrapping, gaskets sealants, and pipe connections
12. Bitumastic coating

###### **77-2.02A(2)(c) Pressure Testing and Disinfection Testing Plan**

Before starting any disinfection work, submit a pressure testing and disinfection testing plan.

The pressure testing plan includes:

1. Methods and procedures proposed
3. Sequence of operations; equipment and materials used
4. Manner of filling and flushing of lines

Submit a disinfection and dechlorination plan sealed and signed by an engineer who is licensed as a civil engineer in the State before starting disinfection operations. The disinfection and dechlorination plan must include the following information:

1. Calculation of anticipated amount of dechlorination chemicals to be used
2. Discharge locations and the approximate volume to be discharged at each discharge location
3. Coordination, drawings or sketches indicating the specific pipeline to be disinfected including location of chlorine injection points, testing points, water quality testing points, locations of temporary bulkheads, air release valve's, and blow-offs
4. All methods and equipment to be used in the dechlorination process
5. Date of flushing and sampling

#### **77-3.02A(2)(d) As-Built Drawings**

Submit As-Built drawings showing pipe size, material, class and/or pipe thickness, the actual locations, (invert elevations) and stations of all valves, tees, special fittings, and stationing of all water service laterals and their run length.

As-Built drawings must be legibly marked in red ink.

#### **77-3.02A(3) Notifications**

Notify the Engineer and the City of Santa Fe Springs:

1. At least 3 business days in advance of any proposed shutdown of existing mains or services.
2. At least 5 business days in advance of the location of the fire hydrants that will be out of service.
3. At least 5 business days in advance of requiring a Cross Connection technician inspection.
4. At least 48 hours before the work requiring a valve operation by the water agency

You can contact the City of Santa Fe Springs at (562) 868-0511.

Notify the Engineer:

1. At least 24 hours in advance of flushing pipe and at least 48 hours before performing a pressure test
2. At least 5 days before disinfection and sampling

Notify the customers affected by a water shutdown by written notice delivered door to door 3 days in advance of the shutdown. The written notice you deliver to customers will be supplied by the City of Santa Fe Springs.

#### **77-3.02A(4) Quality Control and Assurance**

##### **77-3.02A(4)(a) General**

The water supply system must comply with 22 CA Code of Regs §§ 64551-64604, and 24 CA Code of Regs Pt 5.

The outlets of all fire hydrants must be inspected by the Engineer and the Fire Chief of the City of Santa Fe Springs before hydrant will be accepted.

##### **77-3.02A(4)(b) Pressure Testing**

For water pressure testing use the following values:

C=0.25 for PVC pipe with rubber ring or elastomeric gasket joints.  
C=0.50 for ductile iron pipe.

The test pressure must be the pipe pressure classification plus 50 psi as measured at the lowest elevation of the water main under test. No water pipeline is tested at less than the pressure classification or designation of the pipe. No pipeline is tested at less than 200 psi pressure.

### **77-3.02A(4)(c) Chlorination**

Chlorination must be done in the presence of the Engineer and City of Santa Fe Springs.

No chlorination must be started unless it can be completed by 1:00 p.m. on a Thursday.

### **77-3.02A(4)(d) Bacteriological Testing**

After disinfecting and flushing the waterlines, collect water samples and send samples to a laboratory certified by CDPH for bacteriological testing. Submit results of bacteriological testing to the Engineer and the City of Santa Fe Springs.

Sample point must be along every street block and at least every 1,000 feet along the length of the new waterline and one at the end of the new main and at least one at each branch line. Submit proposed locations of the sample points before bacteriological testing to the Engineer and the City for authorization.

### **77-3.02A(4)(e) Backflow Preventer**

Backflow preventers must be tested at the completion of the supply system installation for proper operation by a Certified Backflow Preventer Tester.

The tester must hold a valid certificate as a Backflow Preventer Tester from the county in which the device to be tested is located or, if the county does not have a certification program for Backflow Preventer Testers, the tester must have a certificate from one of the following:

1. The American Water Works Association.
2. A county which has a certification program for Backflow Preventer Testers. The certification under which the tester has been certified must be acceptable to the water purveyor and the local agency having jurisdiction.

Testing for proper operation must comply with the procedures of the county in which the testing is being performed, or, if such procedures are not available in the county, such tests must comply with registration and guidance available from the CDPH, Division of Drinking Water and Environmental Management, Drinking Water Program, 1616 Capital Avenue, P. O. Box 997377, MS 7400, Sacramento, CA 95899, [www.cdph.ca.gov/programs/Pages/DWP.aspx](http://www.cdph.ca.gov/programs/Pages/DWP.aspx) .

Notify the Engineer at least 5 days before testing backflow preventers. Such tests must be satisfactorily completed after installation of the backflow preventer assemblies and before operation of the systems.

One copy of all test results for each backflow preventer must be furnished to the Engineer.

### **77-3.02B Materials**

#### **77-3.02B(1) Delivery, Storage, and Handling**

Unless otherwise specified, all pipe must be transported, handled and installed according to the manufacturer's instructions.

#### **77-3.02B(2) General**

Materials must comply with Part 2 of SSPWC and as specified.

Bitumastic coating must comply with AWWA C151-09.

#### **77-3.02B(2)(a) Untreated Base Material**

Untreated base must be crushed aggregate base or crushed miscellaneous base. If crushed miscellaneous base is used, increase the thickness of the base by 1 inch.

#### **77-3.02B(2)(b) Gravel**

Gravel rock must be clean, hard, durable, 3/4 inch rock. The material gradation must be such that all passes the 3/4-inch screen, and not more than 10 percent passes the No. 4 sieve as determined by California Test 202. Rock must be free from organic material, clay balls, or other deleterious substances.

#### **77-3.02B(2)(c) Rock Bedding**

Rock bedding must be sound crushed rock that passes a 2-1/2 inch sieve and not more than 7 percent will pass through a screen having a 1-inch sieve.

**77-3.02B(2)(d) Concrete bedding**

Concrete used for bedding must be Class 420-C-2000.

**77-3.012B(2)(e) Slurry Sand**

Slurry sand used for pipe bedding or backfill must be Class 100-E-100

**77-3.012B(2)(f) Soil Cement Bedding**

Soil cement bedding must comply with section 19-3.02E(3) of the Standard Specifications.

**77-3.012B(2)(g) Slurry Cement Backfill**

Slurry cement backfill must comply with section 19-3.02D of the Standard Specifications.

**77-3.02B(2)(h) Portland Cement Concrete**

Portland cement concrete must comply with section 201-1 of SSPWC, except reclaimed plastic portland cement is not allowed.

**77-3.02B(2)(i) Reinforcing Steel**

Reinforcing steel must comply with ASTM A615, Grade 40 for sizes #3 and #4, Grade 60 for sizes #5 and larger, and must be rolled from new billets. Tie wire must be 16 gauge-annealed wire.

Do not heat reinforcement for bending.

Tie stirrups to bars at both top and bottom. Bend wire ties away from forms.

Support steel at proper height upon approved chairs and transverse bars with hangers. Maintain clear spacing between parallel bars of not less than 1-1/2 inch.

Bars on footing or slabs on grade must be supported on concrete blocks. Reinforcing steel in beams and suspended slabs must be supported on steel chairs.

Splices must be made with a lap of 40 bar diameters unless noted otherwise.

**77-3.02B(2)(j) Concrete Curing Compound**

Concrete curing compound must be Type 1.

**77-3.02B(2)(k) Emulsified Asphalt**

Emulsified asphalt tack coat must be Grade SS-1h.

**77-3.02B(2)(l) Asphalt Concrete**

Asphalt concrete must be:

1. Grade B PG-63-10 for base course
2. Grade C2 PG-64-10 for finish course
3. Type D2-PG-70-10 for Type 1 asphalt concrete berms
4. Type D2-PG-64-10 for asphalt concrete overlay less than 1-inch thick

**77-3.02B(2)(m) Polyethylene Encasement**

Polyethylene for encasement must be 8 mil minimum, flat tube, virgin polyethylene film and comply with AWWA C105-10, Ansi A21.5-10, ASTM D4976 and NT4112-10.

The film must be marked showing trademark, year of manufacturer, type of resin, specification conformance, pipe size, and the words "warning corrosion protection-repair any damage."

Polyethylene must have a tensile strength of 3600 psi minimum tested under ASTM D882.

**77-3.02B(2)(n) Warning Tape**

Warning tape must be an inert, non-metallic plastic film formulated for prolonged underground use that will not degrade if exposed to alkalis, acids, and other destructive substances commonly found in soil.

Tape must be puncture-resistant and must have an elongation of two times its original length before parting.

For water lines and appurtenances the printed message must be in black, the tape color and message to read as follows:

Message	Color
Caution: Waterline Buried Below	Blue

Ink used to print messages must be permanently fixed to tape and must be black in color with message printed continuously throughout, at approximately 12-inch intervals.

Tape for use to identify below ground recycled water appurtenances must be a minimum 0.004-inch thick and pressure sensitive adhesive backed.

**77-3.02B(2)(o) Sampling Valve**

Sampling valve must be 1/2-inch, brass or bronze, rated at 100 psi minimum, with lever handle and smooth nose outlet without threads.

**77-3.02B(2)(p) Saddles**

Saddles must be all bronze double strap type, with neoprene seal ring gasket.

**77-3.02B(2)(q) Tracer Wire**

Tracer wire must be 10 AWG copper conductor with a 45 mil thick, high density, high molecular weight polyethylene HDPE insulation, and rated for 600 volts. Insulation and jacket must be Restriction of Hazardous Substances (RoHS) compliant and utilize virgin grade material. Insulation color must be blue.

**77-3.02B(2)(r) Pull Rope**

Pull rope breaking strength must be at least 200 pounds for all conduits smaller than 2 inches and at least 700 pounds for larger conduit sizes.

**77-3.02B(2)(s) Guard Post**

Steel posts for guard posts must be standard weight, galvanized steel pipe complying with the details shown.

**77-3.02B(3) Ductile Iron Pipe**

The interior surfaces of iron pipe and fittings must be cement lined in accordance with the latest revised edition of AWWA C-104.

Ductile iron pipe must be push-on joint pipe complying with ANSI/AWWA C 151/A 21.51. Ductile iron pipe must be polyethylene sleeve and double cement-lined.

Fittings must be push-on DI complying with ANSI/AWWA C 153/A 21.53. Joints must be rubber gasketed and designed for a working pressure.

Ductile iron or cast-iron pipe must have bell and spigot joints with Tyton pipe gaskets. Mechanical pipe joints and mechanical coupling assemblies are not allowed unless authorized. All pipe joints for joining pipes of dissimilar metals must be electrically insulated.

Restrained joints must be boltless restrained push-on joint design and must contain a positive axial locking restrained system and be capable of deflection after assembly. Where shown, joints must be restrained with joint restraint material. Restrained joint fitting which require a pipe field weldment is not allowed.

Bolts must be grade B and comply with ASTM Designation A-307. Bolts must have a minimum tensile strength of 55,000 psi. All bolts and nuts must be hot-dip galvanized under ASTM A-153, Class C. Minimum bolt lengths must be the sum of the mating flange thickness, the gasket, and the depth of the nut plus 1/8 inch before torquing. Break-off bolts must have a hole drilled in the shank with the dimensions of 11/32-inch for 5/8-inch bolts and 13/32-inch for 3/4-inch bolts and 2 3/8-inch deep and must be supplied filled with silicone.

**77-3.02B(4) Copper Pipe**

Copper pipe must be seamless annealed copper tube complying with ASTM B88, Type K. Do not splice tubing, unless authorized. All fittings must be compression bronze.

### **77-3.02B(5) Backflow Preventer Assembly**

Backflow preventer assembly must be double check type. Check valves must be OS&Y style. Assembly must include chain lock for valves to prevent tampering. Backflow preventer assembly must be Febco Model LF870.

Backflow preventer assemblies must comply with ANSI/AWWA C 510 and 17 CA Code of Regs §§ 7583-7630.

GSP must be schedule 40 and comply with ASTM A53/A53M, with Class 150 galvanized malleable iron screwed fittings and galvanized steel couplings. The weight of the zinc coating must be not less than 90 percent of that specified in ASTM A53/A 53M.

### **77-3.02B(6) Fire Hydrant**

All fire hydrants must comply with AWWA C503-59. Fire hydrants must be a wet barrel configuration equipped with a 6-inch flange inlet connection. Hydrants must have one 4-inch suction outlet and two 2-1/2 inch outlets with National Standard thread in commercial areas. All hydrants must be equipped with 6-inch diameter and 6-hole buries. They must have bolts for protection against damage to the hydrant bury, and must be installed with bolt head up. The break-off bolts must comply with ASTM A86. The extension piece of the hydrant must be of such length that the hydrant barrel bottom flange or top hydrant bury must be 3 inches above the top of the sidewalk grade.

Plastic caps are not allowed.

### **77-3.02B(7) Air Vacuum and Air Release Valves**

Air vacuum and air release valves must be iron body float type, designed for 150 psi. Valves must be provided with threaded inlets. Floats must be of seamless copper or stainless steel construction. All moving parts must be of bronze and seat washers, and gaskets must be of material ensuring water tightness and a minimum of maintenance.

### **77-3.02B(8) Gate Valve and Box Assembly**

Resilient-seated gate valves must comply with AWWA C-509. Resilient-seated gate valves must be iron bodied with all bronze internal mountings and working parts. Valve stems must contain no more than five percent zinc and two percent aluminum. Resilient-seated gate valves must have non rising stems, 2-O-rings sealed above the thrust collar, with a 2-inch square operating nut, operating clockwise, and designed for 200 psi working water pressure. Resilient-seated gate valves must have their internal surface epoxy coated, except stainless steel, and rubber surface with epoxy applied by the manufacturer of the valve. Resilient-seated gate valves must be one of the following: Metroseal, Clow Corporation, American Darling, U.S. Pipe, Dresser, Water Series 500, Mueller, and M & H, or equal.

Valve boxes must be SDR-35 PVC, single piece cut to fit with W10VB valve box and W106C cover at finished grade. Each valve box cover must have "SFS Water" cast in the top using sharp-faced letters of 1 inch minimum height. No markings or lettering in addition to this requirement will be allowed on the valve box cover.

### **77-3.02B(9) Blow Off Valve Assembly**

Ball valve must be 2-piece, minimum 400 psi WOG, brass or bronze body with chrome plated ball and full port. Ball valve must have reinforced PTFE seats and seals. A stainless steel body and trim is acceptable.

Meter box must be precast concrete box with a hinged cast iron reading lid with no holes. Cover must be factory marked "WATER," or "WATER METER" where appropriate. Provide manufacturer's extensions as required.

### **77-3.02B(10) Pipeline Connections**

#### **77-3.02B(10)(a) General**

Epoxy coating must comply with AWWA C-116.

#### **77-3.02B(10)(b) Fittings**

Cast and ductile iron fittings must have a minimum pressure rating of 350 psi for push-on pipe, and 250 psi for flanged fittings, and be manufactured under ANSI/AWWA C110/A21.10 for short body or AWWA C-153 for long body. Joint type must be push-on joint type and comply with ANSI/AWWA

C111/A21.11 unless otherwise specified. All fittings must be protected with polyethylene tubing. Certificate of Compliance and copies of all test reports must be made available to the Engineer.

### **77-3.02B(10)(c) Flexible Coupling**

Flexible couplings includes 1 steel middle ring, 2 steel followers, gaskets, and sufficient numbers of stainless steel bolts to compress the gasket without distorting the followers. The center ring length must be a minimum of 10 inches long. The thickness of the middle ring must be such that the stress in the steel must not exceed 50 percent of the yield point when subjected to the hydrostatic test pressure of the pipeline. The middle ring thickness must not be less than the thickness of the pipe jointed. Middle rings must be cold expanded a minimum of 1 percent increase in diameter to test weld and the size of the proper dimension. The middle rings must be coated with epoxy. Follower rings must be coated with a compatible shop coat for field coating. Bolts must be 5/8-inch diameter carriage bolts with hexagon nuts. The steel must have a minimum yield strength of 40,000 psi. Bolts and nuts must be stainless steel. Buried couplings must be coated with fusion bonded epoxy and provided with Type 316 stainless steel bolts and nuts. Flexible couplings must be Baker Series 236 or 240, Dresser, Rockwell 441 or R441, Ford, Romac Industries, Inc., 501 or RC 501, or equal.

### **77-3.02B(10)(d) Flanges**

Flange sizes 4 through 24 inches must comply with AWWA C-207, 150 psi primary service rating. Flange sizes 30 through 96 inches must comply with AWWA C-207, Class D, 150 psi. Flange sizes 4 through 96 inches must be furnished in the steel slip-on welding pattern. Flanges must be faced smooth or have a serrated finish of approximately 32 serrations per inch, approximately 1/64 inch deep. Plate or blind flanges must have all flange faces machined flat and must be center drilled and tapped 1 inch iron pipe thread (I.P.T.), 4 through 10 inch; 2-inch I.P.T. 12 inch and larger; and furnished with a standard square head pipe plug. Final machining on the contact faces of all flanges must be done before being welded to the full length adjacent steel plate section. Flange faces must be checked with a straight edge and must be perpendicular to the pipeline. All warped flanges will be returned to the pipe company for adjustment.

### **77-3.02B(10)(e) Gaskets**

Gaskets must be 1/8 inch minimum thickness, cloth inserted rubber, or granite full-face gaskets complying with FED-SPEC HH-P-151. All sizes of flanges for ductile-iron must be rated at 250 psi.

The insulation gasket must fit between the flanges. Insulation gaskets must be full pattern, fabric-reinforced phenolic, neoprene face, 1/8 inch thick. The gasket must have compression strength of 24,000 psi, dielectric strength of 500 V/Mil, operating temperature of up to 175-F, and water absorption of 1.6 percent. A mylar sleeve and double washer must be used for each bolt or cap screw. The 1-piece sleeve and washer must be sleeve thickness of 1/32 inch, washer thickness of 5/32 inch, dielectric strength of 1200 V/Mil, operating temperature of up to 175-F, and water absorption of 0.22 percent maximum. Flange insulation kits must be PSI Products, Inc., Central Plastics Company, CALPICO, Inc., or equal.

### **77-3.02B(10)(f) Flanged Coupling Adapter**

Flanged coupling adapter includes an adapter flange body, follower flange, wedge gasket, and sufficient bolts to compress the gasket without distorting the follower. Adapter flange and follower must be constructed of steel or ductile iron. Ductile iron adapters must meet or exceed ASTM A536, grade 65-45-12. The flange bolt dimensions must meet AWWA C207 for a Class D flange. Gaskets must be composed of a rubber base meeting, or exceeding, ASTM D20003 BA 715 and suitable for use in potable water supply systems. Nuts and bolts must comply with requirements of AWWA C111. The adapter flange and follower must be painted with a factory applied shop coat by Baker Series 601, Smith-Blair 912, 913, and 914, Ford Style FFCA, Romac FCA 501, equal.

## **77-3.02C Construction**

### **77-3.02C(1) General**

Construction work must comply with the Part 3 of the SSPWC and as specified.

The water shutdown must occur from 8 am to 3 pm and be no longer than 4 hour in duration.

All valves, existing or newly installed, must be readily accessible at all times to the City for emergency operation.

All construction equipment involving the filling, pumping, spraying and carrying of water, etc., must be under cross-connection control regulations, of the City Water Division and must be checked by the Cross-Connection Technician before using the equipment on the job site. A City approved backflow device must be used while filling, flushing or chlorinating the mains. Valves at the system connections must not be opened to supply water for any purpose until all testing is accepted by the Engineer.

Determine in advance, the grade of all existing pipelines to which connections are made. Connections must be made with as little change as possible in the grade of the new main. If the grade of the existing pipe is below that of the new pipeline, sufficient lengths of the new line must be deepened so as to prevent the creation of any high spot or abrupt changes in grade. The new line must be laid at specified depths, except for the first joint adjacent to the connection, which must be deflected as necessary to meet the grade of the existing pipe. If sufficient change in direction cannot be obtained by the limited deflection of the first joint, a fitting of the proper angle must be installed. Where the connection creates a high or low spot in the line, a standard air release or blow-off assembly must be installed.

At locations where the water main is to cross an existing street, trench the entire street to verify the details as shown and determine if conflicts with other facilities occurs, before the installation of any pipe.

Pothole as necessary to verify site conditions and utility locations.

Protect in place all utility poles or other utility facilities in the vicinity of trenching/boring/jacking operations with adequate bracing, trench shoring, or by other means authorized.

Provide shoring and bracing to prevent caving of banks. Provide and maintain in place necessary barriers, guardrails or covers while excavations are open. No trenches or excavation are to be left open when you are not present on the site.

The maximum length of open trench must be limited to that length that will permit pipe installation, compacted backfilling, and placement of temporary or permanent pavement at the end of each working day. Plating is allowed at the join points for the next day's work, unless otherwise approved by the Engineer.

Excavations in parkways must be backfilled at the end of each working day.

All ferrous metal fittings and joints must be wrapped with two layers of 8 mil polyethylene which must be secured to the pipe with two-inch wide tape approved by the City of Santa Fe Springs.

Above-ground air release valve and cans must be set back in sidewalk so that the street side of the body is 18-inches clear from the curb face.

Concrete must be placed such that bell ends of fittings must be available for repairs. Concrete placed over joints must be removed.

### **77-3.02C(2) Compaction**

Jetted backfill is not allowed.

Impact, free-fall, or stomping equipment is not allowed unless authorized.

Mechanically compacted trench backfill must be compacted to the following minimum relative compaction requirements:

90 percent Relative Compaction:

1. Within the existing or future traveled way, shoulders, and other paved areas (or areas to receive pavement).
2. Within engineered embankments.
3. Where lateral support is required for existing or proposed structures.
4. Outside the traveled way and other paved areas (or areas to receive pavement).
5. Under Sidewalks.

95 percent Relative Compaction:

1. In the bedding zone as required by Subsection 306-1.2.1 of the Standard Specifications.
2. Subgrade as required by 301-1.3 of the Standard Specifications.
3. 1 foot above the top of pipe within the boring/jacking and receiving pits.

When base or subbase material is placed on the subgrade material, the top 6 inches of such subgrade material must be compacted to a relative compaction of 95 percent.

### **77-3.02C(3) Valve Boxes**

Lower valve boxes, before cold milling. Mark all frames and covers to ensure correct pairing or matching. Adjust all valve boxes to grade no longer than five days after the completion of cap paving. Valve boxes and covers within areas to be paved or graded must be adjusted to finish grade.

Existing valve boxes and covers must be adjusted to grade.

Valve boxes and covers must be adjusted to grade as shown.

### **77-3.02C(4) Valves**

All valves must be installed in accordance with Appendix A of AWWA C500.

No less than 2 snug fitting alignment pins must be used in aligning the flanges for the insulating joints. These pins must remain in place until the bolts have been installed in all the remaining holes and have been drawn up tightly.

Valves must be installed in a level position with the operation stem vertical except where shown otherwise on the Plans.

After installation of the mainline pipe is completed, apply 1 coat of bitumastic coating to damaged areas of buried valves and wrap the entire valve with two layers of 8 mil polyethylene and seal all seams with 2-inch wide tape.

Valves must be stabilized and supported separately from the pipeline as shown.

Mainline and appurtenant valves must be tested for leak-proof tightness after the mainline has been pressure tested, at the test pressure.

Butterfly valves must be installed with the valve operator on the "up station" right side of the valve.

Install valve box, cap and rim, and valve operator extensions of the type shown.

Operator extensions and sleeves must be centered and set plumb over the valve operator nut.

Shaft extension is required where the distance between the finished ground surface and the valve operator nut is greater than 4 feet.

Operator extensions must be fitted with an AWWA 2-inch square operating nut and a tapered socket end for the valve operating nut. The extension shaft must extend from the valve nut to within 18-inches of the finished ground surface.

Operator extension shaft, nut, socket and centerline guide must be painted with 1 coat of primer after fabrication.

The valve box caps must be set flush to 1/4-inch above the finished pavement surface.

Where valve box installations are not within paved areas, a 3 foot square by 4-inch thick asphalt pad must be formed around the cap and slip can.

Valve box caps must fit securely in the slip sleeves, to prevent displacement due to traffic loads

The long axis of the air valve must be set parallel to the street.

### **77-3.02C(5) Manholes**

Bow-off manholes are placed in sidewalk areas, the sidewalk must be saw-cut and removed to the nearest score line. The manhole cover and rim must be set to sidewalk grade and the sidewalk replaced.

Where blow-off manholes are placed in unpaved areas, the cover and rim must be set flush with the existing edge of pavement or as directed by the Engineer.

#### **77-3.02C(6) Thrust Block**

Install concrete thrust and anchor blocks as shown. The Engineer may require any change in direction, location or dimension to accommodate field conditions, conflicts, or soil conditions which may arise. Galvanized steel rod tie-downs, minimum 3/4 inch, are required in certain anchor block conditions as directed by the Engineer. A separation material such as tar paper or wood blocking must be placed between the pipe and the concrete. Remove any temporary concrete thrust block before system connection.

#### **77-3.02C(7) Fire Hydrant**

Fire hydrants must be constructed at locations as shown.

Fire hydrant heads must be set back in sidewalk so that the street face of the body is 18-inches clear from the curb face.

#### **77-3.02C(8) Pipe Installation**

Construct the water main short of proposed join location for testing, disinfection, and flushing purposes. At these locations, install a pipe end cap that is authorized, with a 2 inch standard outlet for draining and flushing purposes.

Copper service lines must be installed as shown.

Line and coat all piping, valves, fittings, pipe hangers, and other ferrous metal surfaces not shop lined and coated.

All exposed buried ferrous metal appurtenances in contact with soil or ground water, including pipe, flanges, nuts, bolts and valves, must be coated with epoxy.

Crushed rock bedding must be placed, when in the opinion of the Engineer, the ground is insufficiently stable to support the pipe or structure. It must be carefully placed and sufficiently compacted by tamping or otherwise in a manner satisfactory to the Engineer so as to support without settlement of the pipe or structure placed upon it. The required depth below the required grade of the bottom of the pipe or structure and to such line is ordered by the Engineer.

In the event of cave-ins of the trench sides where the maximum width is exceeded use slurry cement backfill for a vertical distance of not less than one-half the pipe O.D.

All trenches for pipeline and electrical conduit under roadways, driveways, and parking lots must be backfilled with soil cement bedding.

Place and vibrate slurry sand backfill in such a manner as to prevent floatation of the pipe.

Provide a polypropylene pull rope in each empty conduit.

The piping between the outlet valve and the elbow on the air valve riser must be at a continuous up grade of 1/4-inch per foot.

As soon as conduit installation work is complete, inspected, and authorized, backfill trench excavations, except if specifically requested by the Engineer in order to facilitate verification of pipe grades in critical locations.

Paving for trench cover must be at least the thickness of the adjacent undisturbed paving plus 1-inch, thoroughly compacted in place, and finished to a neat continuous surface.

Place the concrete in such a manner as to prevent floatation of the pipe or conduit. Concrete must be placed from wall to wall in the trench or conduit O.D. plus 12 inches in width and from 4 inches below the pipe to 1/2 O.D. in depth.

Bedding must be compacted by hand or mechanical means before backfilling. The compaction method must provide a uniformly compacted embedment of the pipe.

Impact-type equipment is not allowed for compaction of material over the ductile iron pipe.

You may adjust pipe lengths in the vicinity of utility and oil pipeline if there are conflicts.

All nut and bolt threads must be lubricated with an authorized oil and graphite product.

#### **77-3.02C(9) Polyethylene encasement**

Polyethylene encasement must be installed under ANSI A21.5/AWWA C105, installation Method A, using polyethylene tube for straight pipe and flat sheets for fittings and at valves and other appurtenances. The polyethylene encasement must be taped and secured with general purpose chloride tape 2 inches wide.

#### **77-3.02C(10) Flexible Coupling**

Clean each pipe end for a distance of 6 to 8 inches. Remove oil, dirt, loose scale and rust so that the gaskets will seat on the pipe barrel to provide a positive seal. Wire brushes or non-oily rags may be used, depending on the condition of pipe ends.

Slip the follower rings over the pipe ends and slide them back over the cleaned area.

Wipe the gaskets clean, immerse them in soapy water or approved gasket lubricant, and slide them over the pipe ends.

Clean the coupling middle ring, paying particular attention to flare on the ends where the gasket will seat. Slip the middle ring entirely over one end of the pipe.

Position the end of the pipe to be joined to the other pipe such that a half-inch gap is maintained between pipes. Center the coupling middle ring over the gap.

Lubricate the pipe and the flares of the middle ring with soapy water or gasket lubricant. Slide the gaskets and followers into place making sure the gaskets are pushed under the middle ring flare all the way around.

Nuts should be run on with the rounded or chamfered edge toward the follower ring.

Wrenching must be done progressively, drawing up the bolts on opposite sides, a little at a time and returning to retighten until all bolts have a uniform tightness. During wrenching, you must strike the follower rings with a hammer periodically to make sure it is seating properly.

Torque application must comply with the manufacturer's instructions.

Field-welded joints must comply with AWWA C206.

#### **77-3.02C(11) Connections**

Connections must be made in the presence of the Engineer and the City's Inspector, and no connection work must proceed until authorized.

Where connections are made to existing valves, install all temporary blocking, steel clamps, shackles, and anchors, and replace the valve well and cover.

Dewater existing mains, as required, in the presence of the Engineer and the City Inspector, and dispose of excess water to the nearest catch basin. Water used for flushing or dewatering must not be allowed in the gutter.

Do not connect the new pipeline to existing facilities until the new pipelines have been successfully pressure tested, disinfected, and passed bacteriological testing by an authorized lab.

If required by the Engineer, you must repair the mortar lining inside the steel water main. This work is change order work.

#### **77-3.02C(12) Tracer Wire**

Copper tracer wire must be installed with all pipelines, just below the horizontal centerline of the pipe. The wire must be electrically continuous throughout the entire system, including adjacent service line assemblies. At service lines, the wire must be extended up the bury and secured by a cable lug under the top nut of one set of breakaway bolts. At cul-de-sacs, the wire must be placed in the same trench with the last long side service lateral and extended into the meter box. All splices must be wrapped with PVC tape

and the wire must be tied to the pipe at 10 foot intervals with plastic adhesive tape. Perform the electrical continuity test in the presence of the Engineer and City.

### **77-3.02C(13) Water Meter**

Where connections to existing meters are required, care must be exercised when installing the ball valve on the customer side of the water meter. Some customer services are in deteriorated condition. You must protect existing customer service lines.

When you remove the water meter to install the ball valve, the Engineer may substitute a new or re-conditioned meter in its place, if new meters are not called out.

Before disconnecting domestic water meters, you must check for electrical grounding with a meter or appropriate equipment. Notify the Engineer of any electrical discontinuity. Do not disconnect domestic services from the existing steel water main until the problem is resolved by the Southern California Edison Company and as directed by the Engineer.

### **77-3.02C(14) Protective Coating**

All ferrous surfaces to receive protective coatings must be sandblasted to commercial standards under SSPWC before the application of coatings. All surface irregularities such as weld spatter, sharp corners, rough welds, etc., must be ground smooth. All surfaces must be completely free of grease, oil and other foreign material.

Fire hydrants must be painted with 2 coats of color no. 13591 of FED-STD-595. A field coat must be applied after installation of shock slab.

Structural steel exposed directly to the soil must be coated with bitumastic coating before pouring the thrust blocks.

### **77-3.02C(15) Pipelines**

#### **77-3.02C(15)(a) General**

Water required for the initial filling, pressure testing, leakage testing, flushing, and chlorination, may be obtained from an existing City of Santa Fe Springs' main or fire hydrant by use of a City meter and an authorized backflow prevention device.

All construction equipment involving the filling, pumping, spraying and carrying of water, must be regulated under cross-connection control regulations of the City Water Division and checked by the Cross-Connection Technician before using the equipment on the job site. Valves at the system connections shall not be opened to supply water for any purpose until all testing is accepted by the Engineer.

#### **77-3.02C(15)(b) Testing Pipelines for Leakage and Pressure**

Construct water mains short of the proposed joint location for testing, disinfection, and flushing purposes. At these locations install a Rockwell no. 481 pipe end cap, or equal with a 2 inch standard outlet for draining and flushing purposes.

The new mains must be flushed before chlorination. The flushing velocity to be obtained for pipes must be less than 2.0 ft/sec.

Before testing, the backfill material must have been compacted to the required compaction to the ground surface.

Temporary blow-offs may be used for pressure testing, flushing and disinfecting the main.

Cure concrete anchor and thrust blocks at least 3 days to develop adequate resistance to thrust developed during testing.

All flushing must be made in the presence of the Engineer.

All flanged joints at valves or special fittings must be exposed for visual inspection during the pressure test if requested by the Engineer.

All blow-offs, combination air valves, services and appurtenant facilities must be tested with the main line pipe.

Repair clamps of any kind or type must be not be allowed.

The test pressure must be applied by means of a pump connected to the pipeline in a manner authorized. The test pressure must be the pipe pressure classification plus 50 psi as measured at the lowest elevation of the water main under test. No water pipeline must be tested at less than 200 psi.

Each section of the water main to be tested must be slowly filled with water from the nearest source by means approved by the Engineer. The pipelines must be filled with water and placed under pressure for at least 24 hours before the pressure test.

Accurate means must be provided for measuring the quantity of water required to maintain full pressure on the line for the test period, which volume must not exceed:

For US standard measures: 
$$L_{US} = \frac{CND\sqrt{P}}{1850}$$

For SI units: 
$$L_{SI} = \frac{CND\sqrt{P}}{32600}$$

Where:

$L_{US}$  ( $L_{SI}$ ) = Maximum allowable leakage in gallons (liters) per hour for section of pipeline tested.

N = Number of joints in lengths tested.

D = Diameter of pipe in inches (mm).

P = Test pressure in psi (kPa).

C = 0.25 for PVC pipe with rubber ring of elastomeric gasket joints.

C = 0.50 for ductile iron pipe.

The pressure test must be maintained on the test section at least 4 hours. Whenever test pressure falls an amount of 5 psi, it must be restored.

The amount of water main footage to be tested at one time must be determined by the Engineer.

Perform the leakage test and pressure test concurrently.

All air must be vented from all high points in the water main before making any pressure test. If outlets are not available, taps must be made at the high points to expel the air. Cap the taps after testing.

All valves must be tested for leak proof tightness after the mainline pressure test with the test pressure on one side of the valve and atmospheric pressure on the other side.

Flushing water must be discharged to the nearest catch basin, and must not be allowed to run in the gutter or street.

Make all arrangements as necessary to provide the required flow to obtain the minimum velocity with a 40 psi residual pressure. Providing adequate drainage from the site. The minimum volume of water to be flushed, at required velocity, must not be less than the 1.5 times volume of the pipeline from the point of filling to the point of blow-off.

After the pipeline has successfully met the pressure and leakage test requirements, the disinfection process begins.

### **77-3.02C(15)(c) Disinfection and Bacteriological Testing**

Disinfection must be made in the presence of the Engineer.

Disinfection water must be de-chlorinated by chemical addition, exposure to sunlight or by other means before disposal into the storm drain system.

Chlorinate the lines after pressure and leakage test. Chlorination must comply with AWWA C651.

Chlorine used for disinfection must be liquid chlorine (gas at atmospheric pressure). Tablets may be used with authorization.

Chlorine must be applied by the continuous feed method.

A chlorinating gas-water solution must be injected into the pipeline at the beginning of the test section through a chlorination outlet, blow-off, or air valve by the means of a gas solution feeder chlorinator in combination with a booster pump. The gas-water solution must be fed slowly into the new line to produce an initial minimum dosage of 50 ppm and a residual of not less than 25 ppm in all water within the pipeline after a 24 hour period.

During chlorination remove the combination air valve and the riser pipe capped after being filled with chlorinated water. Before reinstalling, the air valve is sterilized with a 5 percent hydrochlorite disinfecting solution. Reinstalled air valves after chlorination, but before the sanitary sampling.

Water used to convey the chlorine solution throughout the water main must be obtained from the existing distribution system. The rate of flow must be so controlled that water will flow slowly into the undisinfecting main during the application of chlorine.

The end of the main being chlorinated must be kept open and running during the application of chlorine and until the desired concentration is reached, after which each fire hydrant (if any), or any other connection to the water main must be individually opened and flushed with the chlorine solution. After the water main and all appurtenances thereto have been loaded with chlorine to the proper concentration, the water source, chlorine feeder and all other openings to the water main must be closed. The initial minimum concentration must not be less than 50 milligrams per liter of chlorine.

The chlorine content of the water must be tested by the Engineer and if found to be less than 25 milligrams per liter after 24 hours contact, the water main and appurtenances must be rechlorinated and held for another 24 hour period.

During the period of chlorination, all main line valves and blow-off valves must be operated to ensure that the discs and seats are fully open to chlorinated water.

Upon authorization of the chlorine residual at 24 hours by the Engineer, the chlorine solution must be flushed from the water main through each fire hydrant and blow-off. Flushing must continue until the chlorine residual is not more than 0.5 milligrams per liter as determined by the Engineer.

A chlorine solution over 0,5 milligrams per liter cannot be held in the main or appurtenances for more than 5 days from the initial injection to the final flushing.

Coliform bacteria tests must be taken 24 hours after final flushing. Procedures and limits for sampling and testing must comply with AWWA C651.

Service saddles with corporation stops must be installed on the line approximately every 500 ft as directed by the Engineer for bacteria sampling and testing. Testing from a device bolted to the top of fire hydrant burys, and from blow-offs and copper services will also be permitted. Testing directly from hydrants is not permitted.

#### **77-3.02C(16) Guard Post**

Guard posts must be placed in holes excavated to the depth and cross section shown and must be installed plumb.

#### **77-3.02C(17) Salvage**

All existing fire hydrants must be salvaged and delivered to 12636 Emmens Way, Santa Fe Springs, CA, 90670. After pipelines have been tested and disinfected and authorized, remove fire hydrants and fire hydrant burys a minimum of 12 inches below finish grade. Fill fire hydrant burys with concrete. Sawcut existing concrete at construction joints around abandoned fire hydrant burys, remove and dispose of concrete, and place concrete over abandoned fire hydrant burys. If existing fire hydrants are located in an area without concrete, replace with surrounding material.

#### **77-3.02D Payment**

Not Used

### **77-3.03 ABANDON CULVERTS AND PIPELINES**

#### **77-3.03A General**

This work includes abandoning culverts and pipelines on water systems owned by the City of Santa Fe Springs.

Notify the Engineer 3 days before abandoning a culvert or pipeline.

#### **77-3.03B Materials**

Minor concrete must comply with section 90-2 of the Standard Specifications.

Grout must consist of 1 part Portland cement, 0 to 4 parts sand and sufficient water to produce a workable mixture.

Sand must be clean, free draining, and free from roots and other deleterious substances.

Controlled low strength material must comply with section 19-3.02F of the Standard Specifications.

Slurry cement backfill must with section 19-3.02D of the Standard Specifications.

#### **77-3.03C Construction**

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

The portions of waterline which are to be abandoned after connection of the new 12-inch waterlines are complete, must be plugged at each end with cementitious grout or controlled low-strength material.

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

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

Culverts or pipelines that are 12 inches or more in diameter must be completely filled. Fill with one of the following materials:

1. Sand
2. Controlled low-strength material
3. Slurry cement backfill

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

#### **77-3.03D Payment**

Not Used.

### **77-3.04 BORE AND JACK**

#### **77-3.04A General**

##### **77-3.04A(1) Summary**

Section 77-3.04 includes specifications for boring and jacking a 24-inch steel casing beneath the Interstate 5 Freeway, and installing new replacement 12-inch DIP within the steel casing.

The Department will provide a grade point for establishing the casing pipe elevation for you and layout the bore/jacking pit with hubs. The Department will survey to the top of the pit and you are responsible for surveying within the pit.

##### **77-3.04A(2) Submittals**

You must submit for approval, a drawing of the jacking pit, showing the pit dimensions, including a steel plate design and shoring plans as designed by a Civil Engineer licensed in the State.

Submit a list of materials and manufacturer's descriptive data.

### **77-3.04A(3) Quality Control and Assurance**

The supervisor in charge of the boring/jacking/receiving operations must have a minimum of 2 years field experience and must be on the job site at all times when jacking work is in progress.

### **77-3.04B Materials**

The 24-inch diameter steel casing pipe for pipe encasement and crossover have minimum wall thickness of 1/4-inch, and the casing pipes must comply with ASTM A53, A135, or A139, Grade A. The lengths of the casing pipe for separation requirements must be as shown. The lengths of the bore and jack casing pipe must be in even multiples of 10 feet. The casing pipe can be used if it meets the same specifications as new pipe and is authorized.

A band welded to the leading edge of the casing must be placed square to the alignment and not on the bottom edge of pipe. A flared lead section is not allowed.

Casing insulators must be plastic coated casing insulator consisting of a 12-inch wide steel band and a minimum of 6 each 2-inch wide glass reinforced runners. The steel band must be of minimum 14-gauge material, must have a non-conductive inner liner. Runners must be fusion welded to the steel band. The insulator must have a heat fused poly vinyl chloride coating with a minimum thickness of 0.001-inch.

### **77-3.04C Construction**

Construction work must comply with the Part 3 of the SSPWC and as specified.

Groundwater is anticipated. Monitor for and remove groundwater from the pits. If the pits are found to contain contaminated groundwater, treat and dispose of the groundwater from a location at surface grade.

Dewater under section 7-8.6.4 of the SSPWC.

The 24-inch diameter steel casing pipe for pipe encasement and crossover must comply with CDPH separation requirements.

The boring/jacking and receiving pits must have, as a minimum, 10 ft chain link fencing. A Type-K barrier must also be placed around the pits for any portion that lies within public right-of-way. The chain link fence must have reflectors affixed facing traffic.

Install temporary chain link fence. Posts may be metal or wood. Galvanizing and painting of steel items will not be required. Treating wood with a wood preservative is not required. Concrete footings for metal posts is required.

1. Temporary fence that is damaged during the progress of the work must be repaired or replaced at your expense.
2. Holes caused by the removal of temporary fence must be backfilled.
3. Install a visual barrier where shown. The visual barrier must be opaque and installed on the chain link fence per manufacturer's instructions.

The ends of the casing pipe must be sealed sleeve type casing seals constructed of 1/8-inch thick synthetic rubber. The sleeve must be attached to the exterior of the casing and carrier pipes using stainless steel strapping. Casing seals must be authorized. The void area between the carrier pipe and the casing pipe must be filled with air blown sand.

The end of the casing pipe must be square cut by mechanical methods.

The Department may check the grade and the alignment of the casing pipe.

All casing pipe length must be equal to the auger length.

Bore and jack excavation entirely within the jacking head and not in advance of the lead. Set and check a survey grid over the centerline of the pipe jacking or tunneling operation.

Jacking tolerances must be between 0.1 percent right and 0.1 percent left from the survey line and must be between 1 percent up and 1 percent down from the theoretical grade.

A jacking band to reinforce the end of the pipe receiving the jacking thrust must be required.

After jacking equipment and debris from the tunnel have been removed from the approach trench of jacking pit, prepare the bottom of the jacking pit as a pipe foundation. Remove all loose and disturbed material below pipe grade to undisturbed earth and recompact the material.

Tie pipe to thrust block with #5 rebar.

#### **77-3.04D Payment**

Not used

AA

### **Replace section 78 with: 78-2: TRENCHLESS CULVERT**

#### **78-2.01 GENERAL**

##### **78-2.01A General**

##### **78-2.01A(1) Summary**

Section 78-1 includes specifications for furnishing and constructing a trenchless culvert installation using the auger boring method.

##### **78-2.01A(2) Definitions**

**blasting mat:** a heavy rubber mat used for embankment stabilization or to prevent rock or earth fragments from flying about during blasting.

**casing:** A steel pipe installed by trenchless culvert methods that provides a stable underground support system.

**lubrication/injection system:** A system using supply hoses and ports located within the casing fitted with a one-way valve for injection of lubrication material or grout into the annular space between the pipe and the ground.

**obstruction:** Objects located wholly or partially within the cross-sectional area penetrated by the casing or culvert that prevent the forward movement of the casing or culvert after all diligent efforts to advance past the object have failed.

**settlement point:** A point with elevation and spatial location established by survey before construction. The point is re-surveyed periodically to monitor ground movements. The point may be a nail, pin, subsurface settlement rod, borehole extensometer, or other device that can be readily located and surveyed.

##### **78-2.01A(3) Submittals**

##### **78-2.01A(3)(a) General**

For each trenchless culvert installation, submit a 3-ring binder with labeled sections for the following action submittals:

1. Plans and calculations for control and diversion of ground water or flows in existing pipes, including:
  - 1.1. Selection of a flow diversion system and equipment based on compatibility with the properties, characteristics, and behavior of the soils as indicated by the information handout.
  - 1.2. Calculations supporting the capacity and sizing of the flow diversion system based on a 1-year flood event
  - 1.3. Schedule and duration of the flow diversion
2. Description of the methods and equipment to be used including:
  - 2.1. Manufacturers' data sheets and specifications for the trenchless culvert installation equipment and its performance
  - 2.2. All ancillary equipment and its performance
3. Description of the method for removing and disposing of spoil, including:
  - 3.1. Location of disposal sites
  - 3.2. Sample log of volume of spoil removed relative to the advancement of the culvert

- 3.3 Written agreement from property owner.
4. Description of the grade and alignment control system, including:
  - 4.1. Indicator of the location of the culvert's leading edge with respect to line and grade
  - 4.2. Intervals for checking line and grade
  - 4.3. Manufacturer's product literature and drawings showing set-up, support provisions, and other details for the water level, laser, or theodolite systems
  - 4.4. Surveying methods. Submit survey results before the launch and periodically during each drive
  - 4.5. Data demonstrating these systems can achieve the line and grade as shown at any point in the drive
  - 4.6. Samples of grade and alignment progress reports
5. Submit a schedule identifying all major construction activities as independent items. The schedule must include:
  - 5.1. Mobilization
  - 5.2. Trenchless culvert installation
  - 5.3. Intermediate spoil removal
  - 5.4. Final spoil removal
  - 5.5. Site restoration, cleanup, and demobilization
6. Design calculations confirming the proposed culvert material is capable of supporting the maximum stresses anticipated during trenchless culvert installation
  - 6.1. Assumptions used in your calculations must be consistent with the information in the Geotechnical Design report.
  - 6.2. Calculations must include earth and hydrostatic loads, internal forces, external loads such as live loads due to traffic, and any other loads that may be reasonably anticipated during trenchless culvert installation. Describe and show all loads and the assumed maximum drive length.
  - 6.3. Provide an estimate of the maximum internal force expected to complete the drive, accounting for frictional resistance and face pressure along the culvert.
7. Methods for preventing, inspecting and grouting voids
8. Design and layout drawings of the drive and receiving shafts and temporary support during work, including:
  - 8.1. Surface construction
  - 8.2. Profile and depth
  - 8.3. Method of excavation
  - 8.4. Shoring and bracing
  - 8.5. Method of temporary support during work. You must demonstrate that proposed method has been used successfully under like circumstances.
  - 8.6. Dimensions and locations of all equipment
  - 8.7. Plan for removal/abandonment in place of shaft shoring
9. Description of the lubrication injection system, including:
  - 9.1. Manufacturer's product literature and MSDS for the lubricant
  - 9.2. Estimated volume of lubricant that will be pumped
  - 9.3. Lubrication procedures
10. Plan for monitoring ground surface movement caused by the installation, including:
  - 10.1. Method, locations, and frequency of survey measurements
  - 10.2. Method and materials for protecting the surface control points
  - 10.3. Proposed schedule for installing the surface control points
  - 10.4. Preconstruction and post-construction assessments of any roadways or structures located within two pipe diameters or 20 feet, whichever is greater, of the culvert's centerline and the drive and receiving shafts
  - 10.5. Procedures for avoiding excessive settlement or heave
  - 10.6. Photographs or video of existing condition of structures near the culvert's alignment
  - 10.7. Surveying personnel qualifications
11. Layout plan and description of the installation sequence
12. Procedures for complying with Cal/OSHA requirements under section 7-1.02K(6), including:
  - 12.1. Safety procedures and equipment for shaft access and exit
  - 12.2. Ventilation and lighting
  - 12.3. Monitoring for hazardous gases
  - 12.4. Protection against soil instability, ground water inflow, and flooding
  - 12.5. Safety procedures for handling mechanical and hydraulic equipment

- 12.6. Emergency evacuation procedures
13. Contingency plans for the following conditions:
  - 13.1. Damage to the culvert
  - 13.2. Loss and return to line and grade
  - 13.3. Contact with an unexpected obstruction or utility
  - 13.4. Equipment becomes stuck
  - 13.5. Strong hydrocarbon smell detected. Combustible gas meter readings in the shaft or tunnel exceed 10 percent of lower explosive limit (LEL) for methane or possible volatile organic compounds
  - 13.6. Stream flows increase significantly as a result of storms, and threaten to overwhelm bypass system

At or before the preconstruction meeting, submit the action submittals. For each action submittal, obtain the Department's authorization before you perform work based on that portion.

#### **78-2.01A(3)(b) Informational Submittals**

Submit a list with descriptions of similar projects that successfully used the proposed trenchless culvert installation system.

#### **78-2.01A(3)(c) Leakage Testing Submittals**

Not Used

#### **78-2.01A(4) Quality Control and Assurance**

##### **78-2.01A(4)(a) General**

Assign a representative who is thoroughly knowledgeable about the trenchless culvert installation equipment, work, and proposed temporary support method to be present during work to address concerns and emergencies.

Notify the Engineer 2 business days before starting work.

##### **78-2.01A(4)(b) Preconstruction Meeting**

At least 10 days before starting work, you must schedule and attend a preconstruction meeting with the Engineer. Include any subcontractors, manufacturers and other parties involved in the work. Provide a meeting facility that is within 5 miles of the job site or at another location accepted by the Engineer. Select a date and time that is acceptable to the Engineer and all participants will attend.

##### **78-2.01A(4)(c) Daily Operations Logs**

By noon the next day after completion of a work shift, submit daily shaft excavation and support, trenchless culvert installation, and lubrication logs.

Record observations at intervals of no less than 3 times per culvert section, as conditions change, or as directed.

The daily trenchless culvert installation log must include:

1. Date and times of observations
2. Operator's name
3. Installation identification
4. Installed length of culvert
5. Rate of advance
6. Installation forces
7. Problems encountered, possible causes and proposed mitigation
8. Durations and reasons for delay
9. Volume of spoil removed

The daily shaft excavation and support log must include:

1. Date and times of observations
2. Operator's name
3. Installation identification

4. Installed depth of support and excavation depth
5. Rate of advance
6. Installation forces
7. Problems encountered, possible causes and proposed mitigation
8. Durations and reasons for delay
9. Volume of spoil removed
10. Groundwater inflow rates, and possible causes and mitigation

The daily lubrication log must include:

1. Injection locations along the culvert
2. Volume of lubricant pumped throughout a drive
3. Types and amounts of additives used and the time and drive distance when used

#### **78-2.01A(4)(d) Field Leakage Testing**

Notify the Engineer and stop work immediately if there is any indication the culvert has been damaged and may leak. If requested, perform a hydrostatic pressure test within 96 hours in the Engineer's presence. Field leakage testing must comply with section 61-1.01D(2)(a).

#### **78-2.01A(4)(e) Subsurface Monitoring**

Comply with your authorized plan for monitoring ground surface movement.

The survey accuracy of the settlement monitoring points must be within 0.01 foot and referenced to the same control points and benchmarks established for setting out the work. Control points must be tied to benchmarks and other monuments outside of the zone of influence of the operations.

In paved areas, establish surface control points by an inscribed marking or approved surveyor's nail driven flush with the surface.

In unpaved areas, establish surface control points by driving a 2 by 2 by 18-inch long timber stake flush with the ground. Each control point must have a tag or marking indicating the station and offset from centerline.

Install and operate instrumentation to measure surface settlement or heave.

For each trenchless culvert installation and associated surface control points:

1. Submit baseline survey measurements of the control points at least 7 days before work.
2. Take daily survey measurements during the trenchless installation.
3. Submit the daily survey measurements by noon on the following day.
4. Continue taking daily survey measurements until the work is completed.
5. Take weekly survey measurements of surface control points

If the measured settlement or heave exceeds 1/4 inch, you must notify the Engineer.

If the measured settlement or heave exceeds 1/2 inch or damages structures or the roadway, you must repair the damage.

#### **78-2.01A(4)(f) Field Quality Control**

Immediately notify the Engineer when any problems are encountered with equipment or materials, or if you believe the conditions encountered are materially and significantly different than those shown.

#### **78-2.01A(5)(g) Completed Installation Inspection**

Inspect the entire length of the completed trenchless culvert installation using CCTV or human entry. Provide a copy of the inspection video in DVD or MPEG format or a written log with photographs and identification of any problem locations.

## 78-2.01B MATERIALS

### 78-2.01B(1) Welded Steel Pipe

Welded steel pipe must comply with section 70-3.02A and meet the following requirements:

1. Spiral or straight seam welded pipe or seamless pipe
2. May be bare inside and out
3. Square cut with dead-even lengths which are compatible with the trenchless culvert installation
4. Strength sufficient to sustain the vertical and internal loads
5. Meet or exceed the following minimum wall thickness requirements:

**Minimum Wall Thickness**

Pipe Diameter (in)	Up to 150 foot length (in)	Over 150 foot length (in)
18–28	1/4	1/4
30–38	3/8	1/2
40–60	1/2	3/4
62–72	3/4	3/4

Any reductions from values shown in minimum wall thickness table must be supported by appropriate calculations including assumptions regarding soil and groundwater conditions and loading

### 78-2.01B(1)(a) Welded Steel Pipe Couplings and Joints

Couplings and joints must meet the following requirements:

1. Couplings must be flush.
2. Pipe lengths may be joined by a mechanical press fit design with no internal or external bells or field welding. Field welds must comply with section 49-2.02B(1)(b).
3. Joints must be airtight and continuous over the entire circumference of the pipe with a full bead weld equal to or exceeding the pipe thickness when measured at an angle of 45 degrees to the pipe and coupling interface.
4. A qualified welder under AWS D1.1 must perform all welding unless non-welded mechanical press fit design is used.
5. Welded couplings must provide stress transfer across the joints capable of resisting the jacking forces involved.

### 78-2.01B(2) Lubrication

Lubrication materials must include a mixture of bentonite and/or polymers and water. Lubrication ports and pipes must be provided as necessary in the casing to allow for lubrication along the exterior and interior of the pipe string, to maintain installation within the capacity of the pipe and installation equipment used.

## 78-2.01C CONSTRUCTION

### 78-2.01C(1) General

Excavation and backfill must comply with section 19-3.

Handle and dispose of wastewater generated by trenchless culvert installation work under section 13-3.

Place a 6 foot chain link fence and Type K temporary railing around the reception and drive shafts. Place fence outside Type K temporary railing.

Driving and receiving shafts must have bottoms of crushed rock or concrete slabs and sumps to clear ground water and water used to clean culvert. You must line the shafts with filter fabric if ground water is encountered.

Upon completion of the trenchless culvert installation, inspect for voids using your authorized method. Voids in excess of 1 inch must be grouted.

Protect the driving ends of the culvert against spalling or other damage.

Repair or replace any damaged or failed section of culvert at your expense.

Distribute axial forces to the culvert to prevent damage to the ends. Axial forces applied to the culvert must not exceed your authorized estimate of the maximum internal force expected to complete the drive, the safe capacity of the culvert, the installation equipment, shaft thrust block, and passive earth pressures.

If an obstruction prevents completion of the work, plug and abandon the culvert.

Variations from theoretical alignment and grade at the time of completion of trenchless culvert installation must not exceed one tenth of one percent the distance from the jacking point.

You must use your authorized grade and alignment control system. If the pipe installation does not meet the specified tolerance, comply with your authorized contingency plan to correct grade.

#### **78-2.01C(2) Field Welding**

Field welding must comply with section 70-3.03A and section 49-2.02C(2)

#### **78-2.01C(4) Cleanup and Restoration**

Restore and repair any damage resulting from surface settlement or heave caused by excavation or trenchless culvert installation. Restoration must be completed no later than 30 days after completed trenchless culvert installation.

#### **78-2.01D PAYMENT**

Trenchless culvert is measured along the centerline of the casing and parallel with the slope line as shown.

No payment is made for failed bore paths, removal of materials installed in a failed bore path, products taken out of service, or incomplete installations.

### **78-3 WELDED STEEL PIPE JACKING**

#### **78-3.01 GENERAL**

##### **78-3.01A Summary**

Section 78-3 includes specifications for furnishing and jacking welded steel pipe.

##### **78-3.01B Definitions**

Not Used

##### **78-3.01C Submittals**

Do not begin welded steel pipe jacking until approval of your submittal package.

Within 7 days of Contract approval, submit a 3-ring binder with labeled sections for the following:

1. Plans and calculations for control and diversion of ground water or flows in existing pipes, including:
  - 1.1. Selection of a diversion system and equipment based on compatibility with the properties, characteristics, and behavior of the soils as indicated by the soils investigation report
  - 1.2. Calculations supporting the capacity and sizing of the flow diversion system
  - 1.3. Schedule and duration of the flow diversion
2. Manufacturers' data sheets and specifications for the pipe jacking equipment, jacking frame, and ancillary equipment
3. Description of the method for removing and disposing of spoil, including:
  - 3.1 Location of disposal sites
  - 3.2 Sample log of volume of spoil removed relative to the advancement of the pipe
4. Description of the grade and alignment control system, including:
  - 4.1 Indicator of the location of the pipe's leading edge with respect to line and grade
  - 4.2 Intervals for checking line and grade
  - 4.3 Manufacturer's product literature and drawings showing set-up, support provisions, and details for the water level and laser or theodolite systems
  - 4.4 Surveying methods for confirming that the thrust block, guide rails, and jacking frame are installed on the proper line and grade. Submit survey results prior to the launch of each drive.
  - 4.5 Data demonstrating these systems can achieve the line and grade as shown
  - 4.6 Samples of grade and alignment progress reports

5. Description of the method for centering the cutting head inside the borehole
6. Design calculations confirming the proposed jacking pipe can support the maximum stresses anticipated during jacking operations
  - 6.1 Assumptions used in your calculations must be consistent with the information in the geotechnical investigation report.
  - 6.2. Calculations must include earth and hydrostatic loads, jacking forces, external loads, including live loads due to traffic, and other loads. Describe and show all loads and the assumed maximum drive length.
  - 6.3 Provide an estimate of the maximum jacking force expected to complete the drive, accounting for frictional resistance along the pipe.
7. Calculations demonstrating the soils behind the thrust block can transfer the maximum planned jacking forces exerted by the main jacks to the ground with a factor of safety of at least 2.0 without excessive deflection or displacement
8. Methods for preventing voids and for grouting
9. Design and layout drawings of the pipe jacking pits, including:
  - 9.1 Surface construction
  - 9.2 Profile and depth
  - 9.3 Method of excavation
  - 9.4 Shoring and bracing
  - 9.5 Thrust block design
  - 9.6 Dimensions and locations of all jacking equipment
10. Pipe design data and specifications required to withstand the jacking pressure
11. Locations and design of intermediate jacking stations
12. Description of the lubrication injection system, including:
  - 12.1 Manufacturer's product literature and MSDS for the lubricant
  - 12.2 Estimated volume of lubricant that will be pumped
  - 12.3 Lubrication procedures
13. Plan for monitoring ground surface movement caused by the jacking operation, including
  - 13.1 Method, locations, and frequency of survey measurements
  - 13.2 Preconstruction and postconstruction assessments of any roadways or structures located within 100 feet of the pipe's centerline and the pipe jacking pits
  - 13.3 Procedures for avoiding excessive settlement
  - 13.4 Photographs or video of existing damage to structures near the pipe's alignment
14. Layout plan and description of the pipe jacking sequence
15. Procedures for complying with Cal/OSHA requirements under section 7-1.02K(6), including
  - 15.1 Safety procedures and equipment for shaft access and exit
  - 15.2 Ventilation and lighting
  - 15.3 Monitoring for hazardous gases
  - 15.4 Protection against soil instability, ground water inflow, and flooding
  - 15.5 Safety procedures for handling mechanical and hydraulic equipment
  - 15.6 Emergency evacuation procedures
16. Contingency plans for damage to the pipe; loss and return to line and grade; sudden or large increase in jacking forces; contact with an unexpected obstruction or utility; boring machine becomes stuck; jacking forces reach design capacity of the pipe, jacking frame, or exceeding thrust block grade tolerances.

Plans, working drawings, and calculations for pipe jacking operations must be sealed and signed by an engineer who is registered as a civil or structural engineer in the State. The Department will schedule a preconstruction meeting with you, your subcontractors, and other involved parties following acceptance of all submittals.

#### **78-3.01D Informational Submittals**

Submit a list with descriptions of similar projects that successfully used the proposed welded steel pipe jacking system.

#### **78-3.01E Quality Control and Assurance**

##### **78-3.01E(1) General**

Assign a knowledgeable representative who will be present during pipe jacking operations and to address concerns and emergencies.

Notify the Engineer 2 business days before starting work.

### **78-3.01E(2) Daily Operations Logs**

By noon the next day after completion of a work shift, submit daily pipe jacking and lubrication logs.

Record observations at intervals of no less than 3 times per pipe, as conditions change, or as directed. The daily pipe jacking log must include:

1. Date and times of observations
2. Pipe jacking operator's name
3. Tunnel drive identification
4. Installed length of pipe and corresponding tunnel length
5. Rate of advance
6. Jacking forces
7. Problems encountered with the tunnel boring machine or other equipment
8. Durations and reasons for delay

The daily lubrication log must include:

1. Injection locations along the pipe
2. Volume of lubricant pumped throughout a drive
3. Types and amounts of additives used and the time and drive distance when used

### **78-3.01E(3) Field Leakage Testing**

No leakage testing will be required when jacked welded steel pipe is used as casing to carry an inner pipe.

### **78-3.01E(4) Subsurface Monitoring**

An independent specialist must install and operate instrumentation to measure surface and subsurface settlement. The survey accuracy of the settlement monitoring points must be within 0.01 foot.

Subsurface monitoring points must be established at 5 feet and 10 feet above the crown of the proposed tunnel near the jacking shaft, above utilities, on shoulders of the roadway, and at noncritical locations. Surface monitoring points must be established to supplement subsurface monitoring points. Surface settlement must be measured daily or hourly when the heading is within 25 feet of the surface. If from 1/4 to 1/2 inch of settlement is measured, you must take corrective action including filling the voids with grout and limiting the radial overcut.

Surface settlement points located in traffic lanes must be checked before and after tunneling. If 1/4 inch or more of settlement is measured, you must take corrective action including filling the voids with grout.

### **78-3.01E(5) Completed Installation Inspection**

Inspect the entire length of the completed jacked welded steel pipe using CCTV or human entry. Provide a copy of the inspection video in VHS or MPEG format or a written log with photographs and identification of any problem locations.

## **78-3.02 MATERIALS**

### **78-3.02A Welded Steel Pipe Casing**

Steel pipe must comply with ASTM A139 Grade B or API 2B for non-pressurized condition, or AWWA C200 API for pressurized condition; and :

1. Be at least 6 inches larger than the largest outside diameter of the carrier.
2. Be spiral or straight seam welded pipe or seamless pipe.
3. May be bare inside and out, with manufacturer's recommended minimum nominal wall thickness, and no less than the thickness as shown on the plan to meet the installation, loading or carrier requirements.
4. Have gasket-type joints.
5. Have additional joint reinforcement.
6. Have strength sufficient to sustain the anticipated vertical and jacking loads.

### **78-3.02B Slurry**

Use a slurry for soil stabilization during tunnel boring. The slurry must:

1. Be a mixture of bentonite clay and potable water.
2. Have a minimum pH of 6.0.
3. Include only approved chemical additives.

Submit the MSDS for any proposed chemical additives. Identify the source of water for mixing the slurry. Obtain approvals and permits for using water from sources such as streams, rivers, or ponds. A pH test may be required if you use nonpotable water.

### **78-3.03 CONSTRUCTION**

#### **78-3.03A General**

Completely contain all pipe jacking equipment and operations within the allowable work areas.

Excavation and backfill must comply with section 19-2.

Monitor water pollution control practices at the job site. Handle and dispose of wastewater generated by pipe jacking operations under section 13-2.

Place a 6 foot temporary chain link fence and temporary railing (Type K) around the pipe jacking pits and shore the jacking pits to comply with Cal/OSHA requirements. For jacking pits located within 15 feet of traffic lanes, do not extend the shoring more than 3 feet above the pavement. Attach reflectors to the shoring on the sides facing traffic.

Jacking pits must have bottoms of crushed rock or concrete slabs and sumps. Line the pits with filter fabric if ground water is encountered.

#### **78-3.03B Pipe Jacking Operations**

Pipe jacking pits and shafts must be large enough to accommodate all equipment and the selected pipe and to provide safe working conditions.

Use thrust blocks designed to distribute loads uniformly:

1. Deflection of the thrust block is uniform.
2. Excessive loads are not exerted on the shaft.
3. Jacking frame does not become misaligned.

The jacking system must push the pipe through the ground in a controlled manner and sustain the anticipated jacking loads. Monitor the jacking force applied to the pipe and do not exceed the pipe manufacturer's recommendations.

Ensure the lubrication injection system is functional at all times and capable of reducing jacking loads. Use pipe lubrication systems and pumps to convey the lubricant to the injection points. Keep sufficient lubricant on site to avoid loss of lubrication.

Once pipe jacking has started, continue jacking without interruption until the pipe has reached the specified distance. If authorized, you may use a different jacking sequence and method to ensure continued advancement of the pipe and stability of the heading at all times.

Protect the driving ends of the pipe against spalling or other damage.

Repair or replace any damaged or failed section of pipe at your expense.

If an obstruction prevents completion of the work, plug and abandon the pipe.

At your expense, repair or replace any roadways or structures damaged by settlement or heaving caused by pipe jacking operations.

#### **78-3.03C Excess Fluids and Spoil**

Monitor the pumping rate, pressure, viscosity, and density of the boring fluids. Contain excess boring fluids, slurry, and spoil at the entry and exit points of the jacking pits.



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:

<b>Gradation Requirements</b>	
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  $3.5 \pm 0.5$  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  $2 \pm 1/2$  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  $13 \pm 5$  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 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, UT 84062, telephone (801) 785-0505 or from the distributor, Gregory Industries, Inc., 4100 13<sup>th</sup> Street, S.W., Canton, OH 44708, telephone (330) 477-4800.
2. TYPE SRT-31 TERMINAL SYSTEM - Type SRT-31 terminal system must be an SRT-350 Slotted Rail Terminal (6-post system), system length 37'-6", as manufactured by Trinity Highway Products, LLC, and must include items detailed for Type SRT-31 terminal system shown on the plans. The SRT-350 Slotted Rail Terminal (6-post system) can be obtained from the manufacturer, Trinity Highway Products, LLC, P.O. Box 99, Centerville, UT 84012, telephone (800) 772-7976.
3. TYPE 31" X-TENSION - Type 31" X-Tension terminal system must be a 31" X-Tension Guard Rail End Terminal as manufactured by Barrier Systems, Inc., located in Vacaville, CA, and must include items detailed for Type 31" X-Tension terminal system shown on the plans. The 31" X-Tension Guard Rail End Terminal can be obtained from the distributor, Statewide Safety and Signs, Inc., 130 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-SP-MGS terminal system, install the soil tube with soil plate attached at Post 1, hinged breakaway post at Post 2, and 6'-0" W6 x 9 steel posts at Posts 3 through 7. Use a W6 x 15 steel post at Post 1. The soil tube with soil plate must be, at the Contractor's option, driven with or without pilot holes, or placed in drilled holes. Space around the steel foundation tubes must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted.

For Type 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.

For Type 31" X-Tension terminal system, the steel bottom post and I-beam post must be placed in drilled hole. The soil anchor and steel line posts must be, at the Contractor's option, either driven or placed in drilled holes. Space around the steel bottom post, steel line posts and soil anchor must be backfilled with selected earth, free of rock, placed in layers approximately 4 inches thick and each layer must be moistened and thoroughly compacted. All blocks must be plastic.

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

**Add to section 83-1.02G(2) with:**

Painting tubular handrailing must comply with section 59-3.

**Replace the 14th paragraph of section 83-1.02I with:**

Chain link fabric must be 9 gage and comply with AASHTO M 181 for Type IV fabric with a Class B coating.

The bond strength between the coating material and steel of the bonded vinyl-coated chain link fabric must be equal to or greater than the cohesive strength of the PVC coating material.

**Replace the 15th paragraph of section 83-1.02I with:**

The color of vinyl-coated chain link fabric must match color no.34092 of FED-STD-595 or the color used on light poles at Shoemaker Ave Bridge in City of Norwalk.

**Add before the 1st paragraph in section 83-2.02D(1):**

Architectural treatment or surface texture shown on barrier must comply with section 51.

**Replace section 83-2.02E(5) with:**

**83-2.02E(5) Alternative Crash Cushion**

Alternative crash cushion must be installed where shown.

Alternative crash cushion and additional components must comply with the descriptions shown in the following table:

Bid item description	Manufacturer's product description
Compressor Attenuator	TL-3, 6-bay module system
REACT 9CBB	REACT 350 w/Concrete Backup, Uni-Directional
SCI100GM (Smart Cushion)	TL-3, 8 bay module system

The successful bidder can obtain Compressor Attenuator, REACT 9CBB and SCI100GM from the following distributors:

1. Compressor Attenuator, manufactured by Traffix Devices, Inc. in San Clemente, CA 92673, obtained from Main Street Materials, Inc., 27128 Paseo Espada, Suite 1524, San Juan Capistrano, CA 92675, telephone (949) 366-3050, FAX (949) 366-3052.
2. REACT 9CBB, manufactured by Energy Absorption System, Chicago, Illinois, 60602, obtained from National Trench Safety LLC, 7849 Stockton Blvd, Sacramento, CA 95823, telephone (916) 387-6300, FAX (916) 387-6400.
3. SCI100GM (Smart Cushion), manufactured by SCI Products, Inc. in St. Charles, Illinois, obtained from D&M Traffic Services, 843 Reed St., Santa Clara, CA 95050, telephone (408) 436-1127

The price quoted by the manufacturer for Compressor Attenuator crash cushion, FOB San Clemente, California is \$37,000, not including sales tax. The price quoted by the manufacturer for REACT 9CBB crash cushion, FOB Pell City, Alabama is \$32,800 not including sales tax. The price quoted by the manufacturer for SCI100GM (Smart Cushion), FOB Morgan, Utah is \$23,557 not including sales tax.

The above prices will be firm for orders placed within 30 days of Contract award, and provided delivery is accepted within 90 days after the order is placed.

The price quoted for alternative crash cushion includes the concrete anchorage devices and epoxy.

The price quoted for Type REACT 9CBB crash cushion includes the concrete anchorage devices, but does not include the concrete anchor slab or the concrete backup block.

Install the crash cushion under the manufacturer's instructions.

Concrete anchorage devices used for attaching the crash cushion to the base slab must be limited to those that have been provided by the manufacturer.

The concrete anchor slab and backup block must comply with sections 51 and 52.

The concrete anchor slab and backup block must be constructed of concrete containing not less than 550pounds of cementitious material per cubic yard.

For Type REACT 9SCBS crash cushion, W-Beam connections to the barrier must comply with section 83-1. The high strength bolts and nuts for W-Beam connections to the barrier must comply with ASTM A 325/A 325M and A 563/A 563M.

Submit a copy of the manufacturer's plan and parts list, for each model installed, as an informational submittal.

Submit a certificate of compliance for each model of alternative crash cushion.

Payment for structure excavation, structure backfill, and concrete anchor slab with bar reinforcing steel is included in the payment for alternative crash cushion.



**Replace "Reserved" in section 86-1.06B with:**

Traffic Management System (TMS) elements include, 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.

If the construction activities require existing TMS elements to be nonoperational or off line, and if temporary or portable TMS elements are not shown, provide for temporary or portable TMS elements. Obtain authorization on the type of temporary or portable TMS elements and installation method.

Before work, the Engineer, the Department's Traffic Operations Electrical representatives, and you 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 your 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 you. The status list will include the operational, defined as having full functionality, and the nonoperational components.

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. Notify the Engineer at least 72 hours before starting excavation.

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, 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, and temporary or portable detection operations are not shown, provide provisions for temporary or portable detection operations. You 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 your activity, where the elements are not fully functional, immediately notify the Engineer. If the Engineer notifies you that existing TMS elements have been damaged, have failed or are not fully functional due to your activity, the damaged or failed TMS elements, excluding structure-related elements, must be repaired or replaced, at your expense, within 24 hours. For a structure-related elements, you 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 construction.

If fiber optic cables are damaged due to your activities, 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. Fusion splicing is required.

Demonstrate that repaired or replaced elements operate equal to or better than the replaced equipment. If you fail 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.

A TMS element is 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.

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 your activities.

If the pre-construction operational status check identified existing TMS elements, you, 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 you a copy of the certified list of the existing TMS elements within the project limits. 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 your 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 you are required to submit provisions for the replacement of TMS elements that were not identified, submitting the provisions is change order work.

**Add to section 86-2.03B:**

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

**Add to section 86-2.04A:**

Where the side tenon detail at the end of the signal mast arm is shown, you may substitute the applicable tip tenon detail.

The sign mounting hardware must be installed at the locations shown.

Set the Type 1 standards with the handhole on the downstream side of the pole in relation to traffic or as shown.

**Add to section 86-2.05A:**

Conduit installed underground must be Type 1, unless otherwise specified.

**Add to section 86-2.05B:**

The conduit in a foundation and between a foundation and the nearest pull box must be Type 1

**Add to section 86-2.05C:**

If Type 3 conduit is placed in a trench, not in the pavement or under concrete sidewalk, after the bedding material is placed and the conduit is installed, backfill the trench to not less than 4 inches above the conduit with minor concrete under section 90-2, except the concrete must contain not less than 421 pounds of cementitious material per cubic yard. Backfill the remaining trench to finished grade with backfill material.

After conductors have been installed, the ends of the conduits terminating in pull boxes, service equipment enclosures, and controller cabinets must be sealed with an authorized type of sealing compound.

At those locations where conduit is required to be installed under pavement and underground facilities designated as high priority subsurface installation under Govt Code § 4216 et seq. exist, conduit must be placed by the trenching in pavement method under section 86-2.05C.

At other locations where conduit is required to be installed under pavement and if a delay to vehicles will not exceed 5 minutes, conduit may be installed by the trenching in pavement method.

The final 2 feet of conduit entering a pull box in a reinforced concrete structure may be Type 4.

**Add to section 86-2.05B:**

Communication conduits must conform to the details shown.

Communication conduit in structures must be Type 1 unless otherwise specified.

**Add to section 86-2.05C:**

Where edge drains are in the path of conduit routing, you must locate edge drains, then install conduit maintaining a minimum depth of 24 inches. If an edge drain is damaged by your work, repairs will be at your expense.

Conduit adjacent to overcrossings or bridge foundations must be trenched and installed in shoulders as close as possible to the edge of traveled way.

New communication conduits must not terminate in power pull boxes.

Deflections of communication conduit must not exceed one inch/foot when avoiding obstructions. Conduit from typical trench sections must not deflect by more than one inch/foot from the alignment preceding or following communication pull boxes and splice vaults.

Conduit must enter splice vaults and communication pull boxes through knockouts. Conduits entering ends of communication pull boxes must be vertically and horizontally aligned with conduits at the opposite end of communication pull boxes. Conduit ends must not extend beyond interior wall of splice vaults and communication pull boxes. Space around conduits through end walls of splice vaults and communication pull boxes must be filled with minor concrete cement mortar. Do not use conduit bodies or communication pull boxes to change the direction of communication conduit runs.

Bends must not be placed in sections of conduit in excess of those indicated on the plans without the approval of the Engineer. The total degrees of bending in a section of conduit between splice vaults and communication pull boxes must not exceed a total of 180 degrees.

Changes in indicated conduit bends may be made to suit field conditions if the change reduces the degree of bend or increases the radius of bend. The angle of the bend must not be decreased without the approval of the Engineer.

Minimum bending radius for 2 inches, 3 inches, and 4 inches communication conduits must be 12 times the conduit trade diameter. Bends greater than 22 degrees must be factory bends and bends greater than 45 degrees must be galvanized rigid steel with necessary adapters.

**Add to section 86-2.05:**

Separate innerducts must be installed for each fiber optic cable along communication mainlines.

**Add to section 86-2.05A:**

Innerducts must be an extruded flexible, smooth, corrugated, or ribbed high density polyethylene (HDPE) tubing installed inside communication conduit.

Innerduct must be 1.0 inch inside diameter with wall thickness of  $0.0906 \pm 0.003$  inch, and must meet the following requirements:

1. Polyethylene for innerduct must have a density of  $59.6187 \text{ lb/ft}^3 \pm 0.3121 \text{ lb/in}^3$  (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.
2. Tensile yield strength must be 3,300 psi minimum in accordance with the requirements in ASTM Designation: D 638.

Yellow must be used for the 36 SMFO fiber optic cables for video/data and contrasting colors approved by the Engineer for the 48 SMFO for spare fiber optic cable. Exteriors of innerducts must be marked with sequential measurement markings every 3 feet.

The innerducts 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.

**Add to section 86-2.05C:**

Innerduct must be installed using manufacturer's recommended practices using cable pulling lubricants recommended by the innerduct manufacturer and pull ropes. If innerduct is installed with adjacent cables in the same conduit, innerducts and cables must be installed together in one operation. Innerducts must be installed in continuous runs between communication pull boxes and splice vaults without splices or joints.

Ends must be smooth to prevent scraping of cables. Dynamometers must be used to record installation tensions and tension limiting devices must be used to prevent exceeding maximum pulling tensions during installation. Breakaway devices must be used to limit pulling tensions. One device must be placed in series with every element rated for less than maximum pulling tensions of that element. Innerducts must not be stressed beyond the minimum-bending radius allowed by the innerduct or fiber optic cable manufacturer.

Tension must be set to the manufacturer's maximum limit. Maximum pulling tension must be recorded for each innerduct run.

Immediately before installing cables, innerducts must be blown out with compressed air until foreign material is removed. After cables have been installed, ends of innerducts must be sealed with an approved type of sealing compound.

HDPE conduit must be joined by the electrofusion method recommended by the conduit manufacturer, and with equipment approved for the purpose. 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.

**Add to section 86-2.05:**

Comply with 19-3.02D and 19-3.03F. Use colored slurry cement backfill to backfill trenches for the installation of communication conduits that will contain fiber optic cables. Colored slurry cement backfill must comply with section 19-3.

**Add to section 86-2.05:**

**86-2.05E Conduit sealing plugs**

Sealing plugs must be removable and reusable. Sealing plugs must be the split type that permits installation or removal without removing cables. Sealing plugs must seal the conduit simultaneously with one self-contained assembly having an adjustable resilient filler of neoprene or silicone rubber clamped between backing ends and compressed with stainless steel hardware.

To provide suitable sealing between future varying size cables and the plugs, split neoprene or silicone adapting sleeves used singularly or in multiples must be inserted within the body of the plugs. Sealing plugs used to seal the fiber optic conduit must be capable of withstanding a pressure of 5 psi. A sealing plug that seals an empty conduit must have an eye or other type of capturing device on the side of the plug that enters the conduit to attach onto the pull tape so that the pull tape will be easily accessible when the plug is removed.

Install conduit sealing plugs in all fiber optic conduits and innerducts.

**Add to section 86-2.05:**

**86-2.05F Conduit Concrete Backfill**

Adequate spacers, tie-downs and bracing must be provided to maintain conduits in place during the pouring of the concrete. For trenches in paved areas, only the top 4 inch of concrete backfill must be pigmented concrete. At your option, the full depth may have the pigment.

**Replace the 3rd paragraph in section 86-2.06A(2) of the RSS for section 86-2.06 with:**

In a ground or sidewalk area, embed the bottom of a pull box in crushed rock.

**Replace "Reserved" in section 86-2.06B of the RSS for section 86-2.06 with:**

**86-2.06B(1) General**

**86-2.06B(1)(a) Summary**

Section 86-2.06B includes specifications for installing non-traffic-rated pull boxes.

**86-2.06B(1)(b) Submittals**

Before shipping pull boxes to the job site, submit a list of materials used to fabricate the pull boxes to METS. Include:

1. Contract number
2. Manufacturer's name
3. Manufacturer's installation instructions
4. Your contact information

Submit reports for pull boxes from an NRTL-accredited laboratory.

Before installing a pull box and cover, submit the manufacturer's replacement warranty for them.

**86-2.06B(1)(c) Quality Control and Assurance**

**86-2.06B(1)(c)(i) Functional Testing**

The pull box and cover must be tested under ANSI/SCTE 77, "Specification for Underground Enclosure Integrity."

**86-2.06B(1)(c)(ii) Warranty**

Provide a 2-year manufacturer's replacement warranty for the pull box and cover. The warranty period starts on the date of Contract acceptance.

Deliver replacement parts within 5 business days after you receive notification of a failed pull box, cover, or both to the Department's Maintenance Electrical Shop at:

7316 E Bandini Blvd.,  
Commerce,  
CA 90040,  
(213) 620-2194.

### **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

### **86-2.06B(3) Construction**

Do not install a pull box in curb ramps or driveways.

A pull box for a post or a pole standard must be located within 5 feet of the standard. Place the pull box adjacent to the back of the curb or edge of the shoulder. If this is impractical, place the pull box in a suitable, protected, and accessible location.

### **Add to the RSS section 86-2.06:**

#### **86-2.06D Tamper Resistant Cover for Non-Traffic Pull Box**

##### **86-2.06D(1) General**

##### **86-2.06D(1)(a) Summary**

This work includes installing tamper resistant (TR) cover on pull box.

##### **86-2.06D(1)(b) Submittals**

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

Submit warranty documentation before installation.

## **86-2.06D(1)(c) Quality Control and Assurance**

### **86-2.06D(1)(c)(i) Warranty**

Provide a 2-year replacement warranty from the manufacturer of the TR cover and accessories against any defects or failures. The effective date of the warranty is the date of final acceptance.

Provide replacement parts within 5 business days after receipt of failed parts. The Department does not pay for replacement parts. Deliver replacement parts to the following Department's Maintenance Electrical Shop:

Bandini Maintenance  
7300 East Bandini Blvd  
Commerce, CA 90040

### **86-2.06D(2) Materials**

Provide:

1. A factory welded, non-skid, steel tread plate cover marked for the application as shown, with an all around steel security skirt sized to encase the pull box
2. L shape steel anchor rod not less than 1 inch diameter by 4 feet long for the No. 5 pull box, and not less than 1 inch diameter by 5 feet long for No. 6 pull box
3. Stainless steel top cap, steel hex nuts, and lock nuts
4. Epoxy
5. 3/16" x 3" x 8" steel plate

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

1. Factory Direct Fastening (FDF), 1608 A North Hillhurst Ave., Los Angeles, CA 90027. Telephone (800) 942-4844.
2. ERC, Inc, 2970 E Maria, Rancho Dominguez, CA 90221. Telephone (310) 603-2970.
3. Pendarvis Manufacturing, 1808 American St., Anaheim, CA 92801. Telephone (714) 992-0950.
4. Case Automation Corp, 5920 Rickenbacker Ave., Riverside, CA. 92504. Telephone (951) 202-7088 or (951) 493-6666.

TR cover manufactured by FDF is patented and royalty payments may apply.

Stainless steel hardware must have an 18 percent chromium content and an 8 percent nickel content.

Galvanize ferrous metal parts must comply with section 75-1.05.

Provide epoxy to fill the lock nut socket space. 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**

Salvage pull box cover if installing TR cover on existing pull box.

Top of TR cover must be flush with final grade.

Install TR cover by:

1. Digging 8 inch diameter by 5 feet deep hole and installing L shape steel anchor rod, set in the center of the pull box to coincide with the anchor rod. Include a provision for drain hole
2. Installing pull box over the steel anchor rod and conduits
3. Stabilizing and aligning the anchor rod vertical and concentric with the pull box
4. Pouring concrete around anchor rod and outside pull box, 7 inches below finished grade. The skirt will rest on this concrete
5. Bonding and grounding TR cover
6. Positioning the TR cover to encase the pull box. Securing TR cover to the anchor rod with penta head nut.
7. Adding epoxy to fill the lock nut socket space
8. Fixing top cap
9. Tag-welding steel plate across the socket over the top cap lock nut

**86-2.06D(4) Payment**

Not Used

**Add to the RSS section 86-2.06:**

**86-2.06E Communication Pull Boxes**

**86-2.06E(1) General**

Comply with section 86-2.06C.

**86-2.06E(2) Materials**

Communication pull box steel covers must have "CALTRANS COMMUNICATION" markings.

Pull boxes must have tamper proof bolts to secure the cover/metal lid to the box. Tamper proof bolts must be approved before ordering and installing.

Steel covers must be installed and bolted down.

Communication pull boxes shown on the plans in shoulders are shown for general location.

Additional communication pull boxes must not be installed.

**86-2.06E(3) Construction**

Not Used

**86-2.06E(4) Payment**

Not Used

**Add to the RSS section 86-2.06:**

**86-2.06F Fiber Optic Splice Vaults**

**86-2.06F(1) General**

This work applies when fiber optic splice vault is shown on the project plans.

You must not install additional fiber optic splice vaults over those shown on the plans without the Engineer's written approval.

**86-2.06F(1)(a) Summary**

Fiber optic splice vault, cover, and extensions must be of the sizes and details shown on the plans.

Fiber optic splice vaults and covers must be rated for AASHTO HS 20-44 loads, except in areas protected from vehicular traffic, may be rated for AASHTO H5 loads (25 percent of HS 20-44).

Hanger assemblies must consist of not less than 3 hangers evenly distributed. Hangers must be made of a noncorroding material and be free of any sharp edges. Hanger assembly must be provided for a minimum of 8 fiber optic cables and be securely fastened to the side wall with the slack fiber optic cable neatly coiled.

**86-2.06F(2) Materials**

Fiber optic splice vault must be precast of non-PCC material. Non-PCC material must be resistant to fire, chemicals and ultraviolet exposure. The non-PCC material must show no appreciable change in physical properties with exposure to the weather. Non-PCC material must be dense and free of voids or porosity.

Non-PCC vault and covers must be of sufficient rigidity so when a 100 lbf concentrated force is applied perpendicular to the midpoint of one of the long sides at the top, while the opposite long side is supported by a rigid surface, it must be possible to remove the cover without the use of tools. When a vertical force of 1500 lbf is applied, through a 0.5 inch by 3 inch by 6 inch steel plate, to a non-PCC cover in place on a splice vault, the cover must not fail nor deflect more than 0.25 inch.

Covers must be the nonskid type. Cover marking must be "CALTRANS FIBER OPTICS" on each cover. Each cover must have inset lifting pull slots. Cover hold down bolts or cap screws and nuts must be of brass, stainless steel, or other non-corroding metal material.

**86-2.06F(3) Construction**

A reinforced concrete encasement ring must be poured around the collar of the fiber optic splice vault as shown. The concrete for encasement ring must contain not less than 548 pounds per cubic yard.

**86-2.06F(4) Payment**

Not Used

**Add to section 86-2.08A:**

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

**Replace the 1st sentence of the 1st paragraph of section 86-2.08E with:**

Signal interconnect cable must be the 6-pair type with stranded tinned copper no. 20 conductors.

**Replace the table in the 2nd paragraph of section 86-2.08C with:**

<b>Insulation Thickness</b>		
Insulation type	Conductor size	Insulation thickness (mils)
USE, RHH, or RHW	no. 14 to no. 10	45
	no. 8 to no. 2	60
THW or TW	no. 14 to no. 10	30
	no. 8	45
	no. 6 to no. 2	60

**Add to section 86-2.08:**

**86-2.08F Tracer Wire**

**86-2.08F(1) General**

Tracer wire must be provided and placed in communication conduits containing fiber optic.

**86-2.08F(2) Materials**

Tracer wire must be no. 12 minimum solid copper conductor with Type TW, THW, RHW, or USE insulation. A minimum of 3 ft of slack must be extended into each communication pull box and fiber optic splice vault from each direction.

**86-2.08F(3) Construction**

The tracer wire must form a mechanically and electrically continuous line throughout the length of the conduit. Where communication conduit joins metal conduit that has been jacked or drilled, the tracer wire must be bonded to the metal conduit with a brass grounding clamp.

Tracer wire must be spliced at intervals of not less than 500 feet and in pull boxes. Splices must conform to section 86-2.09.

**86-2.08F(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:**

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 7th and 8th paragraphs of section 86-2.11A with:**

Service equipment enclosures must be the aluminum type.

**Replace "Reserved" in section 86-2.11B with:**

Electric service (irrigation) must be from the service points to the irrigation controllers (IC) and to the spaces provided in the irrigation controller enclosure cabinets (CEC) for irrigation controllers as shown.

Irrigation Controller (IC) SV, NV: Electric service (irrigation) must be a metered 120/240 V(ac), single-phase service in a Type III service equipment enclosure.

Service disconnects in service equipment enclosures must be 1-pole, 20-A circuit breaker.

Nameplate inscriptions must be as follows:

Item	Inscription
Metering equipment enclosure	IC SV, NV
Service disconnect	IC 20 A

The inscription on the other nameplates must be the letter designation used on the plans and in the special provisions.

Conductors, conduit, and pull boxes to the pull box adjacent to irrigation controller enclosure cabinets and irrigation controllers are included in the payment for electric service (irrigation).

**Add to section 86-2.12:**

For temporary wood poles, comply with section 48-6.

**Add to Section 86-2.14**

**86-2.14D System Testing and Documentation**

**86-2.14D(1) General**

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

**86-2.14D(1)(a) Submittals**

**86-2.14D(1)(a)(i) 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 4 weeks of receipt.

Modify the documentation if required and submit provisional documentation. The Engineer will approve or reject the provisional documentation within 3 weeks of receipt. Arrange for re-submission in a timely manner to meet the schedule in case the documents are rejected.

Submit revised draft documentation 8 weeks before the start of installation. The revised draft documentation must show the general approach in preparing the final manuals.

Upon approval of the revised draft documentation, provisional documentation must be supplied 3 weeks before the start of site testing. The provisional documentation must be of the same format as the final manuals but with temporary insertion for items that cannot be finalized until the system is completed, tested and accepted.

Submit final documentation no later than 4 weeks after completion of the acceptance tests and it must incorporate all comments made during the approval stages. You will be responsible for all delays caused by noncompliance to the specified requirements.

Final documentation must be approved before its reproduction.

Deliver 10 copies of all final documents. The copies must be 8-1/2" x 11" and bound in 3-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. System Description and Technical Data
  - 1.1. The system description and technical data section must contain an overall description of the system and associated equipment and cables with illustrative block diagrams.
  - 1.2. This section must identify all equipment and cables in the system stating the exact module and option number that are employed in the system. Technical data, specification, and settings for every type of equipment or cable must be provided. Any modification that has been done on the equipment must be clearly described.
2. Configuration of Hardware and Software Documentation
  - 2.1. Provide proper documentation for all configurations of hardware and in-built software. The configurations of hardware and in-built software documentation must include a clear description of the system's functionalities and specifications. Description on each configuration of hardware and in-built software modules and programs must be provided.
3. Operations
  - 3.1. Describe how to operate the system and each particular type of equipment and software. Equipment layout, layout of controls, displays, software operating procedures and all other information required to correctly operate the system and each functional unit must be provided.
  - 3.2. Procedures must also be provided for initial tune-up of the system and adjustment and checkout required to ensure that the system is functioning within the performance requirements. Warning of special procedures must be given. The functions and setting of all parameters must be explained.
4. Corrective Maintenance
  - 4.1. Include fault diagnostic and repair procedures to permit locating and correcting faults at the replaceable module level. Procedures must include alignment and testing of the equipment following repair, the test equipment, tools, diagnostic software required, and the test set up.
5. Preventative Maintenance
  - 5.1. Include procedures for preventative maintenance in order to maintain the performance parameters of the system, equipment, and cables within the requirements of the specifications.

## 6. Test Results

- 6.1. The test result section of the operations and maintenance must include a copy of the results for all the tests that you have conducted.
- 6.2. You must provide system schematic drawings to identify the type of equipment at each location and the function of all equipment. The drawings must show how the system is interconnected. You must also provide a comprehensive list of cabling and wiring to clearly identify the interconnection and labeling of all equipment both in the field, at existing cable node, at existing hub, and at the LARTMC.

### **86-2.14D(1)(b) Quality Control and Assurance**

#### **86-2.14D(1)(b)(i) Subsystem testing**

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.

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. Five 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. Adjustments and alignment
3. 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.

Installation documentation and test results must be provided for all material, equipment and cable before submission of the acceptance test plan and commencement of acceptance tests. The documentation must be in accordance with the contract and must include the following as appropriate:

1. Model and part number for all material
2. Test equipment model number, serial number, settings, and date of last calibration
3. All strap and switch settings
4. Record of all adjustments and levels
5. Alignment measurements
6. Identification of interconnections
7. All factory, laboratory, and site test results

#### **86-2.14D(1)(b)(ii) 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.

#### **86-2.14D(1)(b)(iii) Data Link Testing**

From NWK Hub and from LARTMC, with the communication system functioning under normal condition, "ping" each element (CCTV, TMS, RM) using test computer to verify all of the hardware is properly connected and responding to the assigned IP address. Each element should have a unique IP address and a valid response to a "ping" verifies the reliability of the IP address for each element. Verify that each element responds and record the response time for each ping. The pinging of elements must also include the pinging of multicast addresses.

### **86-2.14D(1)(b)(iv) Video Link Testing**

You must conduct video link testing on the following:

1. Between field cabinet and corresponding field camera sites
2. Between NWK Hub and the corresponding field camera sites
3. Between Los Angeles Regional Transportation Management Center (LARTMC) and corresponding field camera sites

The video link testing must be conducted after submitting the test plan and after receiving approval. Measurements must be made from the baseband-in (output of camera control receiver) to baseband-out connections.

A video communication link must include a video encoder, video decoder, interconnecting optical fiber, connectors, and power supplies. The video link is to provide point-to-point transmission and reception of a full motion National Television System Committee (NTSC) baseband video signal using an optical fiber as the transmission medium. Video system performance tests for any particular video link must be performed after the associated camera has been installed and tested.

Each video link in the communication system must be tested with a video test signal at the encoder input. You must perform all level adjustments and alignments required on the video link in order for it to operate. If any video link fails to meet the performance requirements, you must take all steps necessary to restore the failed link to the required performance.

Each video link in the communication system must be tested for qualitative performance with its associated camera turned on and connected to the video encoder. You must measure and record the received optical power at the optical connector of the video decoder from the video encoder under test using a 90 percent APL (average picture level) flat field input to the encoder.

You must measure, record, and tabulate the decoder's dynamic range at the optical connector of the video decoder from the video encoder under test using a 90 percent APL flat field input to the encoder.

For all tests required under dynamic range at the optical connector, the measured optical attenuation of the fiber being used must be increased to the point at which the video test set just begins to show a 3 dB degradation of the video signal to noise ratio in accordance with TIA-250 video test procedures. The optical receive power into the video decoder must be measured and recorded. Then the optical attenuation must be decreased until the video test set once again shows degradation of the video and registers errors.

The output video signal must be connected to a monitor. The observed picture on the monitor will be assessed for qualitative performance.

You must measure, record and tabulate the receiver's dynamic range at the optical connector of the video decoder from the video encoder under test.

The optical power into the decoder must exceed the manufacturer's specified saturation level. These minimum and maximum receive levels define the video decoder's dynamic range and must meet or exceed the specifications as specified elsewhere under these special provisions.

### **86-2.14D(1)(b)(v) 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.

You must submit 5 copies of the acceptance test plan for approval before commencement of acceptance testing. The acceptance test plan must address the full testing requirements of the specifications.

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

The model and part numbers and date of last calibration of all test equipment must be included with the test results.

Acceptance testing must not commence until all material required is delivered, installed, and aligned and all production test and site test documentation and results have been approved.

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

#### **86-2.14D(1)(b)(vi) Performance Tests**

You must conduct operational performance tests on the following:

1. All video links from the camera output to the input of the display monitors in NWK Hub
2. All data circuits operational from NWK Hub to the field equipment.

Video tests must satisfy the end-to-end performance requirements under normal operating conditions. Video tests must be measured with the video test equipment injecting a test signal in place of the camera output in the field, as appropriate.

You must test the video subsystem and record the results:

1. The video signal to noise must be measured according to TIA-250. The video signal to noise ratio must be measured and recorded with video test equipment providing the video reference signal. The video signal to noise ratio must be greater than 47 dB.
2. The video signal to low frequency noise ratio must be measured according to TIA-250. The resulting video signal to low frequency noise ratio must be greater than 39 dB. If an Automatic Gain Control circuit does not allow measurement as per TIA-250, you must submit an alternative test plan for approval.
3. The video signal to periodic noise ratio must be measured according to TIA-250. The resulting video signal to periodic noise ratio must be greater than 52 dB.

If circuit or element fails to satisfy the specified performance requirements, you must determine the cause and remedy the failure to the satisfaction of the Engineer. The full performance tests must be repeated under operating conditions as determined by the Engineer.

#### **86-2.14D(1)(b)(vii) Functional Tests**

You must test in the presence of the Engineer all integrated system functions to demonstrate that circuits, cameras, camera control, and equipment satisfy the functional requirements of the specifications.

Functional testing must include subjective testing of each camera image and verification of camera control from the camera control unit. The connectivity of each data channel must be demonstrated.

You must document all functional test results.

If the functional test is determined by the Engineer to have failed, you must cease all acceptance testing and determine the cause of the failure. If the failure is due to a defect within your furnished portion of the system, you must make repairs to satisfaction of the Engineer. Acceptance testing, at the discretion of the Engineer, must be repeated from the start of functional tests.

**86-2.14D(1)(b)(viii) Final Acceptance**

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

1. Physical, performance, and functional acceptance tests have been completed and the results are approved.
2. Documentation is completed and submitted.
3. Connections that were changed to perform acceptance tests are restored and tested.

Upon completion of acceptance tests, you must connect all equipment to form a fully operational system.

**86-2.14D(2) Materials**

Not Used

**86-2.14D(3) Construction**

Not Used

**86-2.14D(4) Payment**

Not Used

**Replace 1st paragraph of section 86-2.18 with:**

Place numbers on the equipment as ordered.

**Delete 2nd sentence of 3rd paragraph of section 86-2.18.**

**Add to section 86-2:**

**86-2.19 WARNING TAPE**

**86-2.19A General**

Warning tape must be installed and placed in the trench over new communication conduits as shown.

**86-2.19B Materials**

The warning tape must have:

Description	Parameter
Thickness	not be less than 4 mil
Width	6 inches
Material	pigmented polyolefin film
Tensile strength	minimum of 2,800 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 (323)259-1922,
Message spacing intervals	approximately 30 inches

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

Warning tape must not delaminate when 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.

### **86-2.19C Construction**

Not Used

### **86-2.19D Payment**

Not Used

#### **Add to section 86-2:**

### **86-2.20 FIBER OPTIC CABLE PLANT**

#### **86-2.20A General**

##### **86-2.20A(1) Summary**

Section 86-2.20 includes specifications for installing fiber optic cable plant.

##### **86-2.20A(2) Definitions**

**Breakout method:** See mid-span access method definition

**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 (i.e., patch panel).

**Connectorized:** Termination point of a fiber after connectors have been affixed.

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

**Couplers:** Devices which mate two fiber optic connectors to facilitate the transition of optical light signals from one connector into another. Couplers may also be referred to as: adapters, feed-throughs, and barrels. They are normally located within FDUs mounted in panels. They may also be used unmounted, to join 2 simplex fiber runs.

**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. This number will determine the amount of optical power (in dB) needed to meet the System Performance Margin.

**Fiber Distribution Unit (FDU):** A rack mountable enclosure containing both a connector module housing and a splice module housing in one enclosure.

**FO:** Fiber optic

**FOOP:** Fiber optic outside plant cable.

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

**FTC:** Fiber trunkline cable

**Light Source:** A portable fiber optic test equipment that, in conjunction with a power meter, is used to perform end-to-end attenuation testing. It contains a stabilized light source operating at the designed wavelength of the system under test. It also couples light from the source into the fiber to be received at the far end by the receiver.

**Link:** A passive section of the system, the ends of which are to be connected to active components. A link may include splices and couplers. For example, a video data link may be from video FO transmitter to video FO receiver.

**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.

**Optical Time Domain Reflectometer (OTDR):** A fiber optic test equipment (similar in appearance to an oscilloscope) that is used to measure the total amount of power loss between 2 points and over the corresponding distance. It provides a visual and printed display of the relative location of system components such as fiber sections, splices and connectors as well as the losses that are attributed to each component and defects in the fiber.

**Patch cord:** A short jumper used to join two components.

**Pigtail:** Relatively short length of fiber optic cable that is connectorized on only one end. All pigtails must be tight buffered cable.

**Power Meter:** A 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 power injected by the light source that arrives at the receiving end of the link.

**SM:** Singlemode

**SMFO:** Singlemode Fiber Optic Cable.

**Splice:** The permanent joining of fiber ends to identical or similar fibers.

**Splice Enclosure:** An environmentally sealed container used to organize and protect splice trays. The container allows splitting or routing of fiber cables from and to multiple locations.

**Splice Module Housing (SMH):** Stores splice trays as well as pigtails and short cable lengths.

**Splice Tray:** A container used to organize and protect spliced fibers.

**Segment:** A section of fiber optic cable that is not connected to any active device and may or may not have splices per the design.

**Splice or Fiber Optic Vault:** An underground container used to house excess cable and 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 must 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 Buffered Cable:** Type of non-breakout cable construction where each glass fiber is tightly buffered (directly coated) with a protective thermoplastic coating to 900  $\mu\text{m}$  with the exception of the protective thermoplastic coating. The tight buffered cable must meet all the characteristics of the fiber in the fiber optic outside plant cable specified elsewhere in these specifications.

### **86-2.20A(3) Submittals**

Submit documentation of compliance from manufacturer before ordering the material that shows factory test results.

#### **86-2.20A(3)(a) Factory Testing Documentation**

You must submit the cable manufacturer's Certificate of Compliance with the Fiber Characteristics Tables. Before shipment, but while on the shipping reel, 100 percent of all fibers must be tested for attenuation. Copies of test results must be:

1. Maintained on file with a file identification number by the manufacturer for a minimum of 7 years
2. Attached to the cable reel in a waterproof pouch
3. Submitted to the Contractor and to the Engineer

4. Part 7 of ICEA S-87-640, "Testing, Test methods, and Requirement":
  - 4.1. Water penetration
  - 4.2. Cable impact
  - 4.3. Cable compressive loading
5. Part 8 of ICEA S-87-640, "Finished cable optical performance requirements":
  - 5.1. Attenuation coefficient
  - 5.2. Point discontinuity
  - 5.3. Singlemode cable cutoff wavelength

Submit the manufacturer's recommended procedures for installing fiber optic cable 20 or more working days before installation.

Submit the manufacturer's installation instructions for splice enclosures before installation.

A minimum of 15 working days before the arrival of the cable at the site you must provide detailed test procedures for all field testing for the Engineer's review and approval.

The procedures must include:

1. Test date and description
2. Test plan
3. Test equipment manufacturer and production date
4. Test equipment operating procedures

#### **86-2.20A(4) Quality Control and Assurance**

##### **86-2.20A(4)(a) Fiber optic cable testing**

Test the cable under ICEA S-87-640 and NECA/FOA 301.

Perform the following tests after installation under post splicing tests:

1. End to end attenuation, using optical power meter and light source.
2. Optical anomalies by OTDR in both directions.

Fiber optic cable plant components must be tested:

1. At the factory
2. After delivery to the project site but before installation
3. During final system testing

You must provide all personnel, equipment, instrumentation and materials necessary to perform all non-factory testing. The Engineer must be notified 2 working days before all field tests. The notification must include the exact location of the system or components to be tested.

#### **86-2.20B Materials**

##### **86-2.20B(1) General**

The FO cable must comply with TIA-492 and ICEA S-87-640.

FO cable identification and marking must comply with Part 6 of ICEA S-87-640. Markings must be placed on the cable jacket.

**86-2.20B(2) Fiber optic cable**

Detail specifications for Class IV a dispersion unshifted singlemode optical fibers as described by TIA-492CAAAXBBQB is shown in the following table:

Property	FOTP(s)	Test conditions	Requirement
Cladding diameter $\mu\text{m}$	45 or 48 or 176		$125 \pm 1.0$
Cladding noncircularity	45 or 48 or 176		< 1.0 %
Core/cladding concentricity error $\mu\text{m}$	45 or 176		< 1.0
Coating diameter $\mu\text{m}$	55 or 163 or 173		$250 \pm 15$
Coating/cladding concentricity error $\mu\text{m}$	55 or 163 or 173		< 20
Tensile strength proof test	31		100 kips
Coating strip force lbf	400	1.2 in length	1.0 min, 9.0 max
Attenuation coefficient dB/mi	78 or 61 or 120	@ 1310 nm	0.8
	78 or 61 or 120	@ 1500 nm	0.6
Mode field diameter	164 or 165 or 167	@ 1310 nm	$9.1 \pm 0.5$
			<0.10

**86-2.20B(3) Cable layup**

Outdoor FO cable includes the following components:

1. Central strength member
2. Color coded buffer tubes containing color coded coated fibers and water blocking polymer yarn or tape
3. Outer strength member
4. Core wrap
5. Ripcord
6. Jacket

**86-2.20B(3)(i) Buffer Tubes**

Buffer tube must contain water blocking swellable polymer yarn or tape

Buffer tubes containing fibers must also be color coded with distinct and recognizable colors 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)

**86-2.20B(3)(ii) Ripcord**

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

**86-2.20B(4) Post-installation labels**

Labels must be made of a material designed for permanent labeling. Metal tags must be constructed of stainless steel. Metal tags are required for use on fiber optic cables. Use nonmetal label materials only if approved. At vaults and other underground locations, labels and imprinting must be weatherproof.

**86-2.20B(5) Splice Enclosure**

The splice enclosure must be suitable for a direct burial or pull box application.

The splice enclosure must comply with the following:

1. Nonfilled 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 from 3/8 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

#### **86-2.20B(6) Splice Trays**

Splice trays must accommodate a minimum of 12 fusion splices and must allow for a minimum bend radius of 2 inches. The splice tray cover may be transparent.

Splice trays in the splice enclosure must comply with the following:

1. Accommodate up to 24 fusion splices
2. Place no stress on completed splices within the tray
3. Stackable with a snap-on or hinged cover
4. Secure buffer tubes and pigtails entering the tray
5. 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 distribution unit. Multiple trays must be securely held in place as per the manufacturer's recommendation.

#### **86-2.20B(7) Fiber Distribution Units**

FDU must include the following:

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

Provide strain relief for incoming fiber optic cables. Cable accesses must have rubber grommets or similar material to prevent cables from contacting bare metal. Fibers must be terminated and individually identified in FDUs and on patch panels.

Patch panels must be hinged or have coupler plates to provide easy access and maintenance. Brackets must be provided to spool incoming fibers a minimum of 2 turns. Turns must not be less than 1 foot before separating out individual fibers to splice trays.

FDUs must not exceed 10 inches in height and 15 inches in depth.

Termination and distribution cable trays must accommodate fiber optic cables and must have sufficient tray areas for excess optical fiber storage with provisions to assure that optical fibers do not exceed a 2 inch bend radius. Termination and distribution cable trays must include a designation strip for identification of optical fibers. Splice drawers must include splice trays with each splice tray capable of accommodating fusion type splices. Splice drawers must allow storage of excess lengths of optical fibers of fiber optic cables. Fiber distribution units must be provided with cable clamps to secure fiber optic cables to the chassis.

#### **86-2.20B(8) Fiber Optic Pigtails and Jumpers**

##### **86-2.20B(8)(a) General**

Cable assemblies (jumpers and pigtails) must be products of the same manufacturer. The cable used for cable assemblies must be made with optical fiber meeting the performance requirements.

### **86-2.20B(8)(b) Pigtails**

Pigtails must be of simplex (one fiber) construction, in 900- $\mu$ m tight buffer form, surrounded by Aramid yarn for strength, with a PVC jacket with manufacturer's identification information, and a nominal outer jacket diameter no more than 1/8 inch. Pigtails must be factory terminated and tested and at least 3 feet long.

### **86-2.20B(8)(c) 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.

### **86-2.20B(8)(d) Connectors**

Connectors must be ST for normal applications.

Associated couplers must be the same material as connector housings.

ST type FO connectors must be 1 inch ferrule type with Zirconia ceramic material with a Physical Contact pre-radiused tip.

The connector operating temperature range must be -40 to +70 degrees C. Insertion loss must not exceed 0.4 dB for singlemode, and the return reflection loss on singlemode connectors must be at least -35 dB. Connection durability must be less than a 0.2 dB change per 500 mating cycles per TIA-455-21A (FOTP-21). All terminations must provide a minimum 50 lbf pull out strength. Factory test results must be documented and submitted before installing any of the connectors.

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

Connectors must be factory-installed and tested. There must be no installation of connectors in the field.

Unmated connectors must have protective caps installed.

### **86-2.20B(9) Packaging and shipping requirements**

Package the completed cable for shipment on reels. The cable must be wrapped in weather and temperature resistant covering. Both ends of the cable must be sealed to prevent the ingress of moisture.

Both ends of the cable must be securely fastened to the reel to prevent the cable from coming loose during transit. Six feet of cable length on each end of the cable must be accessible for testing.

Each cable reel must have a durable weatherproof label or tag showing the manufacturer's name, the cable type, the actual length of cable on the reel, your name, the contract number, and the reel number. Provide a shipping record in a weatherproof envelope showing the above information and also include the date of manufacture, cable characteristics such as size, attenuation, bandwidth, factory test results, cable identification number and any other pertinent information.

The minimum hub diameter of the reel must be at least 30 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 must be rolled to prevent loosening of the cable.

Installation procedures and technical support information must be furnished at the time of delivery.

### **86-2.20C Construction**

#### **86-2.20C(1) Pulled cable installation**

FO cable must be installed in conduit system or cable tray system as shown. FO conduit system consists of conduits, communication pull boxes, FO splice vaults, and cabinets.

Cable installation must comply with the procedures specified by the manufacturer. Mechanical aids may be used provided that a tension measuring device is placed to the end of the cable. The tension applied must not exceed 600 lb force or the manufacturers recommended pulling tension, whichever is less.

The FO cable must be installed using a cable pulling lubricant recommended by the cable manufacture and a nonabrasive pull tape. Station your personnel at each pull box, vault, and cabinet through which the cable is pulled to lubricate and prevent kinking or other damage.

During cable installation, the bend radius must be maintained at not less than 20 times the outside diameter of the cable. The cable grips for installing the FO cable must have a ball bearing swivel to prevent the cable from twisting during installation.

#### **86-2.20C(2) Air blown installation**

The fiber cable 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 psi.

The fiber installation equipment must incorporate a mechanical drive unit or pusher that 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 0.625 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(3) Splices and Termination**

The cable must be installed without splices except where specifically allowed as shown. Minimum slack of the cable must be provided at each cable access location without a cable splice. Store a minimum of 30 feet slack of each cable at fiber optic splice locations.

Field cable splices must be done either in splice vaults or in cabinets as shown.

Unless otherwise allowed, the cable splices must be fusion type. The mean splice loss must not exceed 0.07 dB per splice. The mean splice loss must be obtained by measuring the loss through the splice in both directions and then averaging the resultant values.

The mid-span access method must be used to access the individual fibers in a cable for splicing to another cable as shown. 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 including those not being used in the mid-span access.

Use the breakout method to access individual fiber. The cable "breakout" is produced by:

1. Removing the jacket just beyond the last tie-wrap point
2. Exposing 3 to 6 feet of the cable buffers, aramid strength yarn and central fiberglass strength member
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

Cable manufacturer's recommended procedures and approved tools must be used when performing a mid-span access. Measures must be taken to avoid damaging buffer tubes and individual fibers not being used in the mid-span access. You will be allowed to splice up to 5 fibers to repair any damage done during mid-span access splicing without penalty. You will be assessed \$300.00 penalty for each additional splice. Any single fiber may not have more than 3 unplanned splices. If the fiber needs to be spliced more than 3 times, the entire length of fiber optic cable must be replaced at your expense.

The termination splices must connect the cable span ends with pigtails. The termination splices must be placed in splice trays and the splice trays must then be placed in the fiber distribution unit (FDU).

Splice trays must accommodate a minimum of 12 fusion splices. The individual fibers must be looped at least 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 bare optical fibers in the splice tray must be installed so there is no discernable tensile force on the optical fiber.

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

**86-2.20C(4) Post-installation Cable Labeling**

You must label all fiber optic cables with tags. All tags placed along one cable must contain the same cable identification code unique for that cable.

Tags must be placed on the cables at the following points:

1. Fiber optic vault entrance and exit
2. Splice Enclosures entrance and exit
3. FDU entrance

Labels must be affixed to the cable per the manufacturer's recommendations in a manner that will not cause damage to the cable.

**86-2.20C(4)(a) Unique Identification Code Elements**

Unique identification code elements on a tag must consist of the following:

UNIQUE IDENTIFICATION CODE ELEMENTS For Backbone, Distribution or Drop Cables		
DESCRIPTION	CODE	NUMBER OF CHARACTERS
District	District number	2
Cable Type	Fiber: S: Singlemode	1
Cable fiber Count	Number of fibers (Examples: 144 fibers)	3
Route Number	Hwy. Rte (Example: 005)	3
Begin Function	T: LARTMC; H: Hub C: Cable Node M: CCTV Camera Z: Ramp Meter U: Traffic Monitoring. /Count Station/Vehicle Count Station (VDS, TOS) S: Splice Vault	1
Begin Function Number	Unique ID number corresponds to Begin Function (Example: H02 [Hub 02])	2
End Function	T: LARTMC; H: Hub C: Cable Node;M: CCTV Camera; N: CMS Z: Ramp Meter U: Traffic Monitoring/Count Station S: Splice Vault	1
End Function Number	Unique ID number corresponds to Begin Function (Example: H03 [Hub 03])	2
Unique Identifier	XX: If 2 or more cables of the same count are in the same run	2
TOTAL		17

Cables must display one unique identification, regardless of where the cable is viewed. The begin point and end point correspond to end points of cables. The order of the begin and end points follow the hierarchy listed below, where the lowest number corresponding to the begin/end point is listed first.

List of Hierarchy										
1	2	3	4	5	6	7	8	9	10	11
TMC	HUB	Video Node (VN)	Data Node (DN)	Cable Node	CCTV Camera	CMS	Traffic Signal	Ramp Meter	Traffic Monitoring/ Count Station	Splice Vault

**86-2.20C(4)(a)(i) Begin and End Point Determination Examples**

A cable between:

1. HUB and TMC must begin at TMC and end at HUB
2. Vault and CMS must begin at CMS and end at Vault
3. HUB-03 and HUB-01 must begin at HUB-01 and end at HUB-03

**86-2.20C(4)(a)(ii) Cable Code Example**

This cable code 07S060010H02H0302 must be interpreted as is located in District 7, identified as a singlemode fiber optic cable containing 60 fibers, installed along Route 10, beginning in Hub 2, and ending in Hub 3, with unique ID of number 2. The implication for the unique ID is that there may be another 60 fiber optic cable between those hubs. This is an example for a backbone cable.

**86-2.20C(4)(a)(iii) Labeling Jumpers and Pigtails**

Labeling jumpers and pigtails must conform to the following unique identification code elements:

UNIQUE IDENTIFICATION CODE ELEMENTS for JUMPERS (active component to FDU) and PIGTAILS (to connector # on patch panel)		
DESCRIPTION	CODE	NUMBER OF CHARACTERS
Hub Identifier	Hub, LARTMC Numbers or Alphanumeric or both	2
From (Source) Device	FD: FDU (Fiber Distribution Unit)	2
From (Source) Device Identifier	Numbers or Alphanumeric or both	2
Transmitter or Receiver	T or R	1
To (Destination) Device	FD: FDU (Fiber Distribution Unit)	2
To (Destination) Device Identifier	Numbers or Alphanumeric or both	2
Connector Identifier	Connector ID	2
TOTAL		13

A pigtail labeled 01MU01TFD0203 would contain the following information:

Hub	Multiplexer	Transmitting to	To Patch Panel Position (Connector)
01	MU01	TFD02	03

**86-2.20C(4)(a)(iv) Pigtail Code Example**

This pigtail code 01MU01TFD0203 must be interpreted as is located in Hub 1, from multiplexer 01, transmitting to FDU 02 to patch panel position (connector) 03.

### **86-2.20C(4)(a)(v) Label Placement**

Label placement must be as follows:

1. Cables - Cables must be labeled with the unique identification code element method at terminations, even if no connections or splices are made, and at splice vault entrances and exits.
2. Cable to Cable Splices - Cable jackets entering splice enclosures must be labeled in accordance with the identification method.
3. Cable to Fiber Distribution Units - Cable jackets must be labeled at entries to FDUs in accordance with the unique identification code element method. Fibers must be labeled with Fiber IDs and pigtails must be labeled at connectors with Fiber IDs. FDUs must be labeled with Cable IDs on faces of FDUs. If multiple cables are connected to FDUs, each block of connectors relating to individual cables must be identified by a single label with Cable IDs. Individual connections must be marked on the face of FDUs in the designated area with Fiber IDs.
4. Fiber - Fiber labels must be placed next to connectors of individual fibers.
5. Jumpers - Equipment to FDU jumpers must be labeled as to equipment type connected and must be labeled at both ends. FDU to FDU jumpers must be labeled at each end in accordance with the unique identification code element method.
6. Pigtailed - Pigtailed must be labeled at the connector in accordance with the unique identification code element method.

### **86-2.20C(5) Splice Enclosure**

Place the splice enclosure where a splice is required as shown.

The splice enclosure must be bolted to the side wall of the splice vault.

### **86-2.20C(6) Splice Trays**

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.

### **86-2.20C(7) Fiber Distribution Units**

Install components to terminate incoming fiber optic communication cables.

You must install sufficient quantity of fiber distribution units to terminate fibers in the largest cable. Mount fiber distribution in equipment racks as shown. You must terminate optical fibers at fiber distribution units. Optical fibers must be fusion spliced to optical fiber cables assemblies within splice trays.

Optical fibers must be of appropriate lengths to allow future splicing with splice drawers and must be appropriately identified. Splices must be fusion type and must be arranged within splice trays of fiber distribution units in accordance with the organizational design of splice trays. Appropriate protective coatings must be applied to fusion splices.

### **86-2.20D Payment**

Not Used

### **Add to section 86-2:**

#### **86-2.21 PLASTIC SHEET (20 mil)**

Plastic sheet, 20 mil thick, manufactured from high density polyethylene (HDPE) virgin compounds or polyvinyl chloride (PVC) virgin compounds, must be installed in trenches within roadway pavement, 0.10-foot over new communication conduits.

### **Add to section 86-2:**

#### **86-2.22 CLOSED CIRCUIT TELEVISION SYSTEM**

##### **86-2.22A General**

Closed circuit television (CCTV) system consists of installing conduit, pull boxes, conductors, cable, Fiber Optic Distribution Unit (FDU), Category 5E cable, CCTV camera assembly, CCTV pole, CCTV cabinet, Layer 2 Ethernet switch, TIA-232 to TIA-422 Converter, Temperature sensor, and Video Encoder (VE).

### **86-2.22A(1) Submittals**

A minimum of 10 working days before the scheduled delivery of the closed circuit television camera assembly to the project site, submit:

1. A certificate of compliance. The certificate must include a copy of all applicable test reports on the CCTV camera assembly.
2. Four sets of documentation containing complete specifications and operation details of each of the components of the CCTV camera assembly.
3. Four sets of wiring diagrams showing wire colors, functions, and pin assignments for connecting these CCTV camera assembly components to each other and to the encoder.
4. Manufacturer's cut sheets or specifications data of CCTV camera cable assemblies, including connectors with strain relief back shells.
5. A copy of the CCTV camera cable assembly testing procedures and manufacturer's test results.

### **86-2.22A(2) Quality Control and Assurance**

#### **86-2.22A(2)(a) Pre-Acceptance Testing**

For each CCTV system location perform, the specific quality control requirements for testing and documentation. Notify the Engineer in writing 15 days prior to the scheduled testing. You must perform testing at a mutually agreed time and place, and in the presence of the Engineer. Demonstrate all the features of the CCTV system. Provide the necessary equipment required to access the CCTV equipment for testing. The Engineer will use the results from the pre-acceptance testing, and may discuss with the on-site technician, to determine settings used in final testing and documentation of the CCTV system.

#### **86-2.22A(2)(b) Testing and Documentation**

You are responsible for all testing and documentation required for approval and acceptance of the production, installation, and operation of these materials and equipment. The following identifies the specific quality control requirements for testing and documentation:

1. Test cables, after installation with connectors attached, for continuity and shorts or grounds.
2. Adjust and set limit stops to the pan and tilt unit at each camera site to prevent the view of the areas outside of the roadway system. The final settings will be approved by the Engineer.
3. Perform a local functional test at each of the CCTV locations. At your option, the test may be performed directly at the CCTV cabinet or remotely via keyboard or keyboard and personal computer. Verify all the CCTV features. You must provide all test equipment.
4. Arrange to have a technician, qualified to work on the CCTV assembly and employed by the CCTV assembly manufacturer or the manufacturer's representative, present at the time the equipment is turned on.

#### **86-2.22A(2)(c) Warranty**

Furnish a 2-year replacement warranty from the manufacturer of CCTV camera assembly, Layer 2 Ethernet switch, TIA-232 to TIA-422 Converter, Temperature sensor, and Video encoder against defects in materials and workmanship or failures. The effective date of the warranty is the date of acceptance of the installation. Submit all warranty documentation before installation.

Replacement CCTV camera assembly, Layer 2 Ethernet switch, TIA-232 to TIA-422 Converter, Temperature sensor, and Video encoder must be furnished within 10 days of receipt of a failed unit. The Department will not pay for replacement.

Deliver replacement CCTV camera assembly, Layer 2 Ethernet switch and Video Encoder to Department Maintenance Electrical Yard at: 1425 Channing Street, Los Angeles, CA 92618

### **86-2.22B Materials**

#### **86-2.22B(1) Closed Circuit Television Camera Assembly**

Prototype equipment will not be allowed. All equipment must be current standard production units.

The CCTV camera assembly must include these components:

1. Camera
2. Motorized zoom lens
3. Environmental enclosure with sun shield or shroud

#### 4. Pan and tilt unit

The CCTV camera assembly, including the pan and tilt unit must not exceed 7 by 12 by 14 inches (WxHxD). Any external cables must not interfere with or limit the continuous pan and tilt operation.

The CCTV camera assembly must have all necessary wiring, cables, and connectors. CCTV camera assemblies must be plug-compatible, interchangeable and suitable for use with the CCTV camera cable assembly.

You must apply an approved weather-resistant spray to the inside of the connectors before engaging the connectors.

CCTV camera assembly components must be rated for NEMA 4X, IP 66 or IP 67.

#### 86-2.22B(1)(a) Camera

##### 86-2.22B(1)(a)(i) Technical Requirements

Cameras supplied must meet the following:

Parameter	Specification
Optical Device	CCD, Color, interline transfer
Optical CCD Format Size	1/4 - inch format
Horizontal Resolution	520 television lines (minimum)
Sensitivity	At F1.4, Wide Angle 35 IRE 0.5-Lux at 1/60 s, F1.4, Shutter, Color I.R. Cut On 0.05-Lux at 1/2 s, F1.4, Shutter, Color I.R. Cut On 0.2-Lux at 1/60 s, F1.4, Shutter, monochrome mode I.R. Cut Off 0.01-Lux at 1/4 s, F1.4, Shutter, monochrome mode I.R. Cut Off
Zoom and Focus Preset	64 positions with auto focus and ID
Optical Zoom Range	35X, 0.14 to 4.68 inch

The camera must be equipped with an electronic shutter with selectable speeds ranging from 1/60 to 1/30,000 second.

The camera must have the capability of superimposing 3 lines of 24 alphanumeric characters on the upper left corner of the video image. Characters must be displayed in uppercase with white font with a black border. The Camera Assembly must be able to activate or blank the alphanumeric display by commands through the serial port. Each character must be between 25 and 30 TV lines high. Lines 2 and 3 must be programmable, supporting all ASCII symbols from space (20 hexadecimal) to Z (5A hexadecimal). Line 1 must display the word "CAMERA" and some status information generated as follows:

CHARACTER	DESCRIPTION
1 to 6	"CAMERA"
7	space (blank)
8 to 10	Camera ID
11	space
12 to 13	space, LC, LP or IM
14	space
15 to 16	space or preset position number

#### Characters 12-13 Detail

The Camera Assembly must display space (blank) unless one of the conditions below is detected, in which case the Camera Assembly must display the corresponding characters. If more than one condition

is detected, the characters corresponding to the highest priority condition must be displayed (1 being highest priority and 6 being the lowest priority). The conditions are as follows:

Condition	Char.	Priority
Local	LC	1
Iris Manual	IM	2
Low Pressure	LP	3
Alarm 2	A2	4
Alarm 3	A3	5
Alarm 4	A4	6

The Camera Assembly must be able to detect and retain in memory the above alarm and status conditions. The data must also be sent to the CCT through the serial port. The description is as follows:

1. Local: This condition is activated at the CCTV site using a laptop computer.
2. Iris Manual: This condition is activated by command through the serial port.

### Characters 15-16 Detail

If a preset position is active, the Camera Assembly must display the corresponding preset position number in decimal, sector id, character generator.

### 86-2.22B(1)(a)(ii) Electrical Requirements

Cameras supplied must meet the following:

Parameter	Specification
Operating Voltage	120 V(ac) ± 10 percent (external adapter allowed)
Power Consumption	100 W (Maximum)
Video Output Signal	NTSC, 1 V p-p at 75 ohms, unbalanced
Video Output Connector	Standard BNC bulkhead on rear of camera
Signal To Noise Ratio	>50 dB
Synchronization	Internal sync or phase adjustable line lock
Video Output Level	1.0 V p-p (75 Ω composite)
Gain Control	Automatic
Automatic Back Focus (Automatic White Balance)	Required

Programming must be stored in nonvolatile memory and the CCTV assembly firmware must be updateable via serial communication.

### 86-2.22B(1)(a)(iii) Environmental Requirements

Cameras supplied must meet the following:

Parameter	Specification
Operating Temperature	From -30 to 165 °F
Operating Humidity	From 0 to 100 percent noncondensing

### 86-2.22B(1)(b) Motorized Zoom Lens

#### 86-2.22B(1)(b)(i) General

The lens must have motors for zoom, focus and iris.

The lens must have capability for focus and zoom preset positions. A telescopic converter or extender must not be used to achieve required focal length range.

**86-2.22B(1)(b)(ii) Technical and Functional Requirements**

The lens must meet the following:

Parameter	Specification
Iris	Motorized, with automatic and manual adjust modes
Operating temperature	From -30 to 165 °F
Focal Length	0.14 to 4.68 inch (Optical power not less than 35X)
Lens Aperture	From F1.4 to F4.2
Horizontal angle of view at Maximum Focal Length	55.8 to 1.7 degrees

When the camera is pointed at a very bright object and or when the camera and lens is first turned on, the image produced by the lens and camera combination must not optically "oscillate" (i.e., produce an image that alternates from too light to too dark) or otherwise be unstable.

Each lens must have an automatic, motor-driven iris with manual override.

The lens must include mechanical or electrical means to protect the motors from over running in the extreme position.

The iris must be controlled directly through the camera in automatic mode and from any keyboard connected into the camera system in the manual mode. The automatic iris must provide continuous aperture adjustments of the lens as determined by the amount of light reaching the camera imager. The power supply and electronics for iris motor must be contained within the environmental housing.

When the power is removed from the lens, the lens iris must automatically close.

The motorized-iris cable must be strain relieved or sufficiently rugged so the cable will not fail at the point where it leaves the lens assembly.

**86-2.22B(2) Environmental Enclosure**

**86-2.22B(2)(a) General**

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

It must operate on a voltage range of 120 V(ac) ± 10 percent power source.

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

The enclosure must include a sun shield or shroud to provide protection from direct solar radiation.

You have the option of providing a sealed, pressurized Integrated Optics Cartridge (IOC) housed in a NEMA 4X rated enclosure.

The enclosure or IOC must be pressurized with 5 psi dry nitrogen. The enclosure must have a valve for pressurizing. In addition, a pressure relief valve with a 20 psi rating must be provided to protect the enclosure from overcharging. The notation "CAUTION - PRESSURIZED" must be printed on the enclosure. The letter height must be at least 1/4 inch.

**86-2.22B(2)(b) Technical and Functional Requirements**

The housing must meet the following:

Parameter	Specification
Construction	All aluminum
Finish	White, light beige or gray that is either baked enamel or powder coat
Weight	Less than 20 lb excluding heater
Camera Mounting	Platform mount with adjustment fore and aft

The camera lens must be positioned in the center of the housing window.

The housing unit must have lens preset capabilities.

The housing must not interfere with the widest viewing angle of the motorized zoom lens.

The camera enclosure must not incur any physical damage after a shock, return to normal operation immediately and operate within the specified vibration (see Note 1 below table).

Parameter	Specification
Shock	Up to 10 G while in nonoperation mode
Vibration	From 5 to 60 Hz with 0.083 inch total excursion, and 5 G rms vibration from 60 to 1000 Hz.

Note 1: Where the manufacturer's cut sheet or specification data does not contain shock and vibration data a listing of at least 2 project sites with identical equipment, with similar installation conditions and similar traffic patterns showing continuous functional performance of at least 2 years may be substituted.

Enclosure must include a sun shield or shroud to protect the housing from the direct rays of the sun. The sun shroud must be made specifically for the model of enclosure that is selected.

### **86-2.22B(3) Pan And Tilt Unit**

#### **86-2.22B(3)(a) General**

The pan and tilt unit must consist of the pan and tilt unit itself along with any electrical or communication interfaces required to perform the functions specified.

The pan and tilt unit must be designed to operate under a full range of environmental conditions. The pan and tilt unit with camera assembly mounted must withstand a wind load of 100 mph. The cable connector must be fully weather protected. External body components must be manufactured from aluminum that have been anodized, painted or coated to prevent oxidation and corrosion.

Access into the pan and tilt unit for routine maintenance or adjustments must not require removal of the pan and tilt from the installation site, or removal of the camera enclosure from the pan and tilt unit. Access cover must be readily removable regardless of the tilt position.

**86-2.22B(3)(b) Technical Requirements**

The housing must meet the following:

Parameter	Specification
Pan and Tilt Worms	Ground and polished Stainless Steel
Pan and Tilt Worm Gears	Nonmetallic material
Camera Mount	Compatible with camera housing
Bearings on Rotating Surfaces	Heavy duty roller type
Overload Protection	Provided - internal
Operating Temperature	From -30 to 165 °F
Construction	Corrosion resistant steel or aluminum
Finish	Weather resistant paint or polyurethane
Seals	"O" ring or gaskets for all weather protection of pan and tilt unit and cables.

**86-2.22B(3)(c) Functional Requirements**

The housing must meet the following:

Parameter	Specification
Braking: Pan And Tilt	Mechanical or Electrical to limit coast
Overload Protection	Motors: Impedance protected
Angular Travel	Pan: From 20 to -90 degrees horizontal, Continuous Tilt: From +90 up to -90 degrees down
Pan Speed	From 0.1 to 80 degrees/s variable-speed
Tilt Speed	From 0.1 to 40 degrees/s variable-speed
Pan And Tilt Position Preset	Positions camera to a predetermined azimuth, elevation and lens position (Minimum of 64 Presets)

**86-2.22B(3)(d) Pan and Tilt Stops**

The pan and tilt unit must have pan and tilt stops. The settings of these pan and tilt stops will be determined by the Engineer.

**86-2.22B(4) Software and Operational Requirements**

The proposed camera protocol must include integrated video camera system communication drivers for flexibility and system interoperability. The camera system must support both serial TIA-422 and TIA-232 communication channels at a minimum, allowing field selection of the following protocol drivers as required;

1. Camera and pan and tilt functions are operated via TIA-232 and TIA-422 serial communication.
2. Communication bytes described below are expressed in hexadecimal. When any other format is specified, the values must be translated into hexadecimal.

The protocol for communication from CCT to Camera Assembly must be as follows:

Byte	Description
1	1B
2-4	43, 54, 56
5	Camera Assembly ID, least-significant byte
6	Camera Assembly ID, most-significant byte
7	Number of command and data bytes
8	COMMAND
9-X	DATA
X+1	CHECKSUM

1. Byte 1: 1B implies communication from the Central Communications Central (CCT) to Camera Assembly.
2. Byte 2 through 4: ASCII code values for "CCTV."
3. Byte 5 and 6: Camera Assembly ID. This ID will be used to communicate to a specific CCTV on a multi-drop communication line.
4. Byte 7: This number will indicate how many command and data bytes will follow.
5. Byte 8: See Table 1 below.
6. Byte 9 to X: See Table 1 below.
7. Byte X plus 1: Checksum. This is a hexadecimal sum of Bytes 1 to X.

TABLE 1			
Byte 7	Byte 8 ASCII		Byte 9 to Byte X
	Char.	Description	
1	Q	Status Query	-
1	R	Pan Right	-
1	L	Pan Left	-
1	U	Tilt Up	-
1	D	Tilt Down	-
1	I	Zoom In	-
1	O	Zoom Out	-
1	N	Focus Near	-
1	F	Focus Far	-
1	J	Iris Open	-
1	K	Iris Close	-
1	M	Iris Manual	-
1	m	Iris Auto	-
1	p	Pan Stop	-
1	t	Tilt Stop	-
1	z	Zoom Stop	-
1	f	Focus Stop	-
1	i	Iris Stop	-
Up to 33 (Decimal)	C	Set Char. Display	Up to 32 ASCII Char.
1	A	Activate Char. Display	-
1	B	Blank Char. Display	-
2	P	Set Preset Position	Position Number (1-10 Decimal)
2	G	Go to Preset Position	Position Number (1-10 Decimal)
2	S	Set Relay	Relay Number (1-6)
2	s	Reset Relay	Relay Number (1-6)
1	E	Turn on Camera	-
1	e	Turn off Camera	-
1	X	Reset Camera	-
9	Y	Go to coordinates	Coord. data (8 bytes)

The protocol for communication from Camera Assembly to CCT must conform to the following:

1. The Camera Assembly must send a message back to CCT in response to every (valid) command received as follows:

BYTE	DESCRIPTION
1	09
2 to 4	43, 54, 56
5	Camera Assembly ID, L.S. byte
6	Camera Assembly ID, M.S. byte
7	0C
8	COMMAND
9 to 11	STATUS
12 to 19	POSITION DATA
20	CHECKSUM

1. Byte 1: 09 implies communication from the Camera Assembly to CCT.
2. Byte 2 through 4: ASCII values for CCTV.
3. Byte 5, 6: Camera Assembly ID.
4. Byte 7: This number indicates that there are 12 bytes to follow before checksum.
5. Byte 8: This will be identical to byte 8 of the message from CCT.
6. Byte 9-11: Status bytes. These bytes are described in the tables below. Bit 1 is the least significant bit (LSB).

Byte 9			
BIT	FUNCTION	0	1
1	Focus	Auto	Manual
2	Color/Mono	Color	Mono
3	Color/Mono	Auto	Manual
4	Integration	Auto	Manual
5	Integration	Decrease	Increase
6	Data Flow Control	Off	On
7	Iris	Auto	Manual
8	Char. Display	Blank	Active

Byte 10			
BIT	FUNCTION	0	1
1	Reserved		
2	Local/Remote	Local	Remote
3	Camera power	Off	On
4	Pressure	Good	Low
5	Alarm 2	No alarm	Alarm present
6	Alarm 3	No alarm	Alarm present
7	Alarm 4	No alarm	Alarm present
8	Video status	Video Present	No Video

1. No Video: The Camera Assembly must have the circuitry to detect absence and presence of video sync signal on its video input. Absence of the video sync signal must indicate a no-video condition.
2. Byte 11: This byte will equal zero if the camera is not positioned at any of the preset positions. Otherwise this byte will contain the preset position number (1 to 10 decimal).

- Byte 12-19: These bytes must contain pan, tilt, zoom and focus position data. The values for the extreme positions are described below. The values range from 0000 to 0FFF (0 to 4095 decimal) and must change linearly as the positions are varied. The extreme position data are as follows:

Byte 12	Byte 13	
00	00	Pan Left
0F	FF	Pan Right
Byte 14	Byte 15	
00	00	Tilt Down
0F	FF	Tilt Up
Byte 16	Byte 17	
00	00	Zoom Out
0F	FF	Zoom In
Byte 18	Byte 19	
00	00	Focus Far
0F	FF	Focus Near

- Byte 20 is checksum. The checksum is a hexadecimal sum of all the bytes 1 to X.

### 86-2.22B(5) Closed Circuit Television Camera Cable Assembly

#### 86-2.22B(5)(a) General

Not Used

#### 86-2.22B(5)(b) Technical Requirements

The CCTV camera cable assembly must conform to the following:

- General

Overall Cable, Nom. weight/1,000 feet not to exceed:	300 lb
Overall Cable Minimum Bending Radius:	9 inches
All Materials, Temperature Rating, meet or exceed:	From -30 to 165 °F
Overall Cable, Outside Diameter, not to exceed:	1.7 inches
Outside Jacket, Tinned Copper Braid Shield, minimum:	80 percent
Pulling tension, maximum:	500 lb
Overall Cable, Outside Jacket:	Black Thermoplastic Elastomer

- For video - Coax Cable

Coax Tinned Copper Braid Shield, minimum:	95 percent
Coax Insulation Material:	Solid Polyethylene
Coax Core Outside Diameter:	0.121 inch
Coax Outside Diameter:	0.178 inch
Coax Outside Jacket:	Polyvinyl chloride

- For power - Shielded group of 3 twisted pairs of no. 22 AWG cables. The individual conductors must be color coded with PVC insulation for 300V minimum and used for distance up to 750 ft for 115 V(ac).
- For data – Shielded group of 5 twisted pairs of no. 26 AWG cables
- For ground – A solid no. 8 AWG ground wire must be provided between the camera assembly and the CCTV cabinet grounding electrode..

### **86-2.22B(5)(c) Testing Requirements**

Comply with section 86-2.14B for testing of hybrid cables and connectors. Any cable lengths found to have faults must be replaced and retested. You must dispose of the removed faulty cable. The cable termination must be randomly inspected for contact crimping quality control. Any contact found not crimped with the correct crimping tool or defective must be rejected. You must redo the termination until all defects are corrected.

Before the beginning of work, the coaxial cable length of hybrid cable must be tested for attenuation and faults using a time domain reflectometer (TDR). One or more of the following defines a fault in a long length of cable:

1. Return loss measurements indicating that attenuation exceeds 3 dB at 5 to 30 MHz in a portion of cable less than 10 feet long.
2. A return loss measurement indicating that there is a short in the cable.
3. A return loss measurement indicating a cut or open circuit in the cable.
4. A visual inspection that reveals exposure of or damage to the cable shielding

### **86-2.22B(5)(d) Construction**

Control cable must be routed from the CCTV camera assembly to the video encoder and AC power inside the camera pole. Wiring must run continuous from source to destination without splices.

Cable slack of not less than 3 feet must be provided for equipment movement at pull boxes, vaults or cabinets. The cable must be secured and coiled neatly.

The cables and connectors must be installed to allow the camera and lens to be disconnected without removing the environmental camera housing.

Provide cable grip and J-hook.

You are responsible for all testing and documentation required to establish approval and acceptance of the production, installation, and operation of these materials and equipment.

You must provide all materials necessary to make the connectors functional. All materials used to make the connectors must be compatible and must adhere to manufacturer's recommendations.

### **86-2.22B(6) Closed Circuit Television Cabinet**

#### **86-2.22B(6)(a) General**

Model 334-TV cabinet must consist of the following:

1. Housing and Mounting cage
2. Power distribution assembly
3. Thermostatically controlled fan
4. All necessary mounting hardware, wiring, foundation, anchor bolts, and other equipment

#### **86-2.22B(6)(b) Materials**

##### **86-2.22B(6)(b)(i) Housing and Mounting Cage**

The housing and the mounting cage must conform to those of the Model 334 controller cabinet of the TEES and to all addendums thereto current at the time of project advertising. Police panel is not required.

##### **86-2.22B(6)(b)(ii) Power Distribution Assembly**

The power distribution assembly must consist of the following: one 30 A, 120 V(ac) minimum, single pole main breaker; three 15 A, 120 V(ac) minimum, single pole secondary breakers; 8 standard 120 V(ac) receptacles; and one duplex, 3 prong, NEMA Type 5-15R grounded utility type outlet. The power distribution assembly must protect the equipment powered by the assembly from power transients. Over voltage protection must be provided for the power distribution assembly and must contain as a minimum, a surge arrester which must reduce the effect of power line voltage transients and be rated as follows:

Recurrent Peak Voltage	184 V
Energy Rating (Minimum)	20 J
Power Dissipation, Average	0.85 W
Peak Current for pulses less than 7 microseconds	1250 A
Stand-by Current for 60 Hz sinusoidal	1 mA or less

**86-2.22B(6)(b)(iii) Thermostatically Controlled Fan**

The thermostatically controlled fan must provide 150 cubic foot per minute of ventilation. The fan must be activated when the temperature inside the cabinet exceeds 75 degrees F and shut off when the temperature is less than 64 degrees F. All vents must be filtered.

All cabinet assemblies must be tested to demonstrate the correct function of all controls in the presence of the Engineer.

**86-2.22B(7) Layer 2 Ethernet Switch**

**86-2.22B(7)(a) General**

Layer 2 Ethernet switch must be installed in CCTV cabinets.

The Layer 2 Ethernet switch may be connected via small form-factor pluggable (SFP) modules to other Layer 2 Ethernet switches in the fiber trunk line or to a Layer 3 Ethernet switch in the communication hubs.

All non-Ethernet equipment in field cabinets must be converted to Ethernet using compatible suitable terminal servers in the field cabinet to enable connection to the Layer 2 Ethernet switch in the cabinet. Connections are to be done using Cat 5E patch cables which must be manufacturer certified as TIA-568 standard compliant. Connectors at both ends of the Cat 5E patch cables must be 8P8C type modular connectors using T568B termination. Appropriate length must be used for all cables with sufficient length to allow for cable organization using cable ties but cable lengths must not to exceed 368 feet.

Depending on whether the field cabinet has an AC or DC power supply (possibly from a Solar power generator), Layer 2 Ethernet switch must have compatible AC or DC power supply that must meet the following requirements.

<b>Power Supply</b>	
Electrical Requirement	Input Voltage: From 18 to 60 V(dc), 88 to 300 V(dc) and 85 to 265 V(ac) Input Current: From 0.8 to 1.3 A

Layer 2 Ethernet switches must be provided with compatible fiber optic SFP modules to populate the SFP slots on the switches as required. The choice of SFP module types must be determined based on the distance of the fiber link involved.

Layer 2 Ethernet switches must, at a minimum, meet the following specifications:

<b>Layer 2 Ethernet Switch</b>	
Ethernet Downlink Interface	At least 4 Ethernet 10/100 Mbps ports
Ethernet Uplink Interface	At least 2 dual purpose uplink ports (each dual purpose uplink port has one 10/100/1000 Mbps Ethernet port and one SFP-based Ethernet port, one port active)
Expansion module	8 additional 10/100 Mbps Ethernet ports and/or 8 additional 100 base-FX multi mode fiber ports
Application Interfaces	TCP/IP, UDP/IP, SNMP v.2 or v.3, Hypertext Transfer Protocol (HTTP),
Additional Requirements	IP Multicast capable IEEE 802.1Q standard VLAN
Environmental Requirements	Minimum Range of Operating Temperature: -30 to +165 °F Humidity: From 10 to 95 percent condensing
Mechanical Requirement	Maximum Device Size (H x W x D): 6 inches x 6 inches x 4.5 inches Integrated mounting including either 4 keyhole screw mounts in 19 inch rack or mounting bracket using DIN rail

**86-2.22B(7)(b) Small Form-Factor Pluggable (SFP) Modules**

SFP modules for the Layer 2 Ethernet switches must be from the same manufacturer of the Ethernet switch. SFP modules must be of appropriate type depending on the distance covered by the fiber optic link and must also be compatible with the appropriate type of fiber used in the fiber optic link in question. All SFP modules must be compatible with LC (International Electrotechnical Commission standard # IEC 61754-20) type fiber connector. SFP modules used in Layer 2 Ethernet switches must be one of the following types:

<b>SFP Module Type</b>	<b>Line Speed</b>	<b>Fiber Type</b>	<b>Wavelength</b>	<b>Typical Transmission Distance</b>
100Base-LX	100 Mbps	Single Mode	1310 nm	6.2 miles
1000Base-LX/LH	1000 Mbps	Single Mode	1310 nm	6.2 miles
1000Base-ZX	1000 Mbps	Single Mode	1550 nm	43.4 miles

All SFP modules must support a minimum connection distance of 6 feet.

SFP module models used with Layer 2 Ethernet switches must be specified by the manufacturer as compatible with the switch they are used with. SFP modules must have a minimum temperature range of -30 to +165 degrees F. The transmit and receive power range of different types of SFP must be as per the following table:

<b>SFP Module Type</b>	<b>Transmit Power (dBm)</b>	<b>Receive Power Range (dBm)</b>
100BASE-LX	-8 to -15	-8 to -28
1000BASE-LX/LH	-3 to -9.5	-3 to -20
1000BASE-ZX	+5 to 0	-3 to -23

In case of too high transmit power at receiving end, 5 or 10 db inline optical attenuator must be used at both ends to avoid overloading the receiver.

**86-2.22B(8) Layer 3 Ethernet Switch**

**86-2.22B(8)(a) General**

Layer 3 Ethernet switch must be installed in cable node A.

Layer 3 Ethernet switch must be connected to other switches in data cabinet, video cabinet or IP node in a fiber trunk line or to other switches in hub locations using its SFP fiber ports and fiber patch cables via the Fiber Distribution Unit (FDU) of the hub. The IP enabled equipment in the hub location must be connected to Layer 3 Ethernet switch ports using Cat 5E patch cable or fiber patch cable. Layer 3 Ethernet switch must have the option to upgrade to 10 gigabit SFP fiber ports

Layer 3 Ethernet switch must comply with the following:

Ethernet layer 3 switch:	
Electrical Requirement	AC Input Voltage: From 100 V(ac) to 240 V(ac) AC Input Current: From 5 to 2.5 A, 50 to 60 Hz
	DC Input Voltage: From -36 to -72 V(dc) DC Input Current: From 10 to 5 A Modular Power supply with externally available backup (stackable)
Network/ Interface	Ethernet Downlink Interface: At least 24 10/100/1000 Ethernet ports
	Ethernet Uplink Interface: At least 2 10 Gigabit Ethernet interface module slots
	IP Multicast capable, IEEE 802.1Q standard VLAN
	Application Interfaces: TCP/IP, UDP/IP,SNMP v.2 and v.3, Hypertext Transfer Protocol (HTTP), Telecommunications Network (Telnet)
	Layer 3 IP services including routing
	Compatible to existing network and switch management and monitoring software
	Power connector: multiple pin (screw attached terminal not recommended)
Environmental Requirement	Operating Temperature: -30 to +165 °F Humidity: From 10 to 85 percent noncondensing
Mechanical Requirement	Maximum Device Size: 18 inches perimeter Integrated mounting including 4 keyhole screw mounts in 19" rack

**86-2.22B(9) TIA-232 to TIA-422 Converters**

The port-powered 2-channel TIA-232 to TIA-422 converter must convert TIA-232 TD and RD lines to balanced TIA-422 signals. The unit can be powered either from DTS or RTS of TIA-232 handshake lines. Only 1 of these lines must be present, and the unit will work regardless whether the lines are high or low. The unit can also be powered externally on the terminal blocks. Both the TIA-422 driver and receiver are always enabled.

**86-2.22B(9)(a) Connections for the TIA-232 to TIA-422 converter:**

The converter is configured to transmit in both directions between an TIA-232 and TIA-422 system. The TIA-232 side is pinned out to connect directly into the COM port on the computer/laptop or any other DTE device as shown on Table 1. The TIA-422 side of the converter is pinned out as described in Table 2. When connecting to an TIA-422 system, the converter must be connected with proper polarity as shown in Table 2. When no data is being sent and the driver is enabled, the TIA-232 line is negative and the TIA-422 line TD(A) is negative with respect to TD(B).

Table 1 – TIA-232 Pin Out	
Signal	DE-9 Female Pin #
TD	3
RD	2
RTS	7
CTS	8
DTR	4
DSR	6
DCD	1
GND	5

Table 2 – Connection to an TIA-422	
Terminal block	TIA-422
TD(A)	RD(A)
TD(B)	RD(B)+
RD(A)	TD(A)-
RD(B)	TD(B)+
GND	GND

**86-2.22B(9)(b) Specification for the TIA-232 to TIA-422 converter:**

1. Communication: TIA-422
2. Data Rate: Up to 115.2 kbps max.
3. Power: Port-powered from handshake lines on the TIA-232 side
4. Dimensions: 3.5 x 1.3 x 0.7 inches
5. Temperature: From -30 to 165 degrees F

**86-2.22B(10) Category 5E Cable**

**86-2.22B(10)(a) General**

**86-2.22B(10)(a)(i) Summary**

Section 86-2.22B(10) includes specifications for installing category 5E cable.

**86-2.22B(10)(b) Materials**

Category 5E cable must be the unshielded, outdoor rated, non-gel filled type, and must meet the requirements of TIA 568, Category 5E Cable.

Category 5E cable must meet the following:

1. The cable must contain 8 conductors, each of which must be no.24, minimum, solid bare copper conductors. Each conductor must be insulated with polyolefin, polyethylene, polyvinyl chloride or fluorinated ethylene propylene material.
2. The cable jacket must be rated for a minimum of 300 V and 140 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 ratings.
3. The finished outside diameter of the cable must not exceed 1/2 inch.

**86-2.22B(10)(c) Construction**

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

Terminate the ends of category 5E cable at the cabinet with Type 110 punch down blocks.

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.

**86-2.22B(10)(d) Payment**

Not Used

**86-2.22B(11) Temperature Sensor**

**86-2.22B(11)(a) General**

Temperature sensor must be IP enabled and accessible remotely. Temperature sensor must comply with the following:

IP enabled Remote Temperature Sensor:	
Electrical Requirement	5 to 30V(dc) external power
Network/ Interface	Ethernet Interface: One 10/100base-TX 8P8C Ethernet port
	Built-in digital temperature sensor, accurate to +/- 0.36 degree F with range from -30 to +165 degrees F
	Open Source Plugins in VB Script and C languages
	Application Interfaces: TCP/IP, Hypertext Transfer Protocol (HTTP), accessible via any web browser
	Data Logging Software
Environmental Requirement	Operating Temperature: from -30 to +165 degrees F Humidity: From 1.0 to 99%
Mechanical Requirement	Maximum Device Size: 6" H x 6" W x 6" D
LED	Power , Network Link
Warranty	1 year minimum

**86-2.22B(12) Video Encoder**

Electrical power requirements for all new equipment, including surge suppression of transient voltage spikes must be documented and must be met for each equipment configuration.

The video encoder must have remote diagnostic capabilities from the LARTMC and locally in the field cabinet including a built in web server. You must provide IP video encoder manufacturers' recommended hardware options such as lightning arrestors and multiplex devices for use with multiple input IP video encoder.

The video encoder must be measured as each unit furnished, installed, configured and tested as a fully functional and integrated system component.

Video encoder must have the following features:

Video Encoder	
Feature	Parameter/Remarks
Video Standard	SMPTE-170M, 75 ohm
Video Input	75 ohm, BNC Connector
Video Compression	MPEG-4 Part 2 (ISO/IEC 14496-2) and Motion JPEG
Video Transmission	768 kHz at 30 fps
Network Interface	Auto sensing 10/100 Base T port, IEEE 802.3
Protocol Support	TCP/IP, UDP/IP (unicast and multicast), Telnet
Frame Rate	Up to 30 fps at 2 CIF
Network Connector	8P8C modular
Serial Data Connector	DE-9
Serial Line Standard	Selectable between TIA-232, TIA-422, TIA-485
Serial Port Function	CCTV command and control
Serial Console Port	TIA-232
Encoder Software Updates	Via Serial port or network port
Encoder Configuration	Via Serial port or network port
Encoder Identification	IP addressable
Image quality and frame rate	configurable
Physical	1U height Rack Mountable, 12" Deep
Operating Temperature	From -30 to 165 °F
Operating Humidity	80 percent maximum relative humidity, noncondensing
Power Input	Power supply (5 V(dc) maximum), 6 watts (maximum) consumption

### 86-2.22C Construction

#### 86-2.22C(1) General

You must make the necessary adjustments on different components of the CCTV camera assembly. This includes the back-focus and tracking adjustments on the lens and color balancing of the camera.

You must ensure the back-focus adjustment on the camera is set and maintained when adjusting the focal length from zoom to wide angle. You must make this adjustment with the lens iris at full open position. This adjustment must be made so when the zoom is adjusted from long range (telephoto) to wide angle, no refocusing is necessary.

The Engineer will notify you of the pan and tilt presets and stops for you to set prior to the CCTV camera assembly installation check. You must perform the installation check in the presence of the Engineer. At your option, the test of the operation (pan, tilt, zoom, iris and wiper) of the pan and tilt unit may be performed at the CCTV cabinet adjacent to the camera or by remote keyboard location. You must furnish a color video monitor, for testing only, to view the actual camera image. Upon completion of the installation check, the Engineer will verify operation of the pan and tilt unit. Additional adjustments necessary to restore the presets and stops to acceptable parameters is at your expense.

#### 86-2.22D Payment

Not Used

**Add to section 86-2:**

**86-2.23 WORK AT NORWALK HUB**

**86-2.23A General**

The work at the existing Norwalk hub building, located at Northbound Route 5 South of Rosemead Boulevard, PM 6.8, must consist of adding 2 ZX SFP modules in the existing Type 3 switch at Norwalk hub, provide all connecting wires, and cables, and incidentals required to make the installed equipment at the Norwalk hub building fully operational.

**86-2.23A(1) Testing**

You must test installed equipment per manufacturer specifications before installation. You must follow the following testing procedures during installation from end to end.

**86-2.23A(1)(a) System testing**

System testing must include test plan, pre-installation testing, acceptance testing, and final testing.

**86-2.23A(1)(b) Test plan**

Five copies of a plan for installation, configuration and testing must be developed and submitted within 30 working days for approval. This plan must detail method of installation, configuration and testing for equipment and the associated schedule of activities.

**86-2.23A(1)(c) Pre-installation testing**

Installed components must be tested before installation in the presence of the Engineer.

A physical inspection of furnished equipment must be performed for quality of workmanship free of manufacturing defects and documentation must be provided.

**86-2.23A(1)(d) Acceptance testing**

The acceptance testing must comply with the approved test plan include conducting acceptance tests and subsequent retests, and documentation of the test results.

Functional tests of complete system must demonstrate that the equipment satisfies the functional requirements of the specifications. The connectivity of each communication link must be demonstrated, including IP and all communication links from field devices to the Norwalk hub.

Functional test results must be documented and submitted for review and approval, no later than 2 weeks after completion of the acceptance tests and comments made during the approval stage must be incorporated in this documentation.

If any aspect of the functional tests is determined to have failed, all acceptance testing must cease, the cause of the failure must be determined and repairs must be made to the satisfaction of the Engineer. Acceptance testing must, at the discretion of the Engineer, be repeated from the start of functional tests. You must be responsible for any delay caused by replacement of noncompliant equipment.

**86-2.23A(1)(e) Final acceptance**

Final acceptance must not occur until you have complied with the following conditions:

1. Testing has been completed and the Engineer has approved the results.
2. Equipment manuals have been approved and submitted.
3. Connections that were changed to perform tests were restored and tested.

**86-2.23B Materials**

**86-2.23B(1) Cords and Cables**

Cable ties, wire mounting devices, nonmetallic cable strain relief, and fixed diameter clamps must be used in the controller cabinet and equipment rack. Wire management brackets must be used every 2 feet at the cabinets to route cable. Cables and wire management system components must avoid physical interference between cables and adjacent equipment, allow equipment to be removed from cabinets without physical interference and keep terminal blocks clearly visible.

### **86-2.23B(2) Equipment Manuals**

Manuals must provide all information necessary to operate, maintain, and repair all of the equipment installed by you. Manuals must include Master Item Index that describes the purpose of each manual and brief description to the directory. It must also reference equipment manuals as required for additional and support material. It must contain an overall description of the system and associated equipment and cables with illustrative block diagrams. This section must identify all equipment and cables in the system stating the exact module and option number that are employed in the system. Manufacturer contact information, technical data specification, parts lists, part description, and settings for every type of equipment or cable must be provided. Clearly describe any modification done on the equipment. Manuals must include fault diagnostic and repair procedures to permit the location and correction of faults to the level of each replaceable module. The manual must include procedures for preventive maintenance in order to maintain the performance parameters of the system, equipment and cables within the requirements of the specifications.

Equipment must conform to rules and regulations of the Federal Communications Commission (FCC).

Prototype equipment is not acceptable. Equipment must be off the shelf, of current standard production units manufactured by original equipment manufacturer, and must have been in production for a minimum of 6 months. Rebuilt, modified, or reconditioned equipment is not allowed.

Metal filler plates must be furnished to cover any unused channel slots or card slots for rack mounted equipment and card cage assemblies. Equipment installation must not affect the controller cabinet door normal operation.

### **86-2.23C Construction**

#### **86-2.23C(1) Access to Existing Norwalk Hub**

Work in the existing Norwalk hub building and is limited to the hours between 6:00 a.m. and 4:00 p.m. Mondays through Fridays and between 7:00 a.m. and 3:30 p.m. on Saturdays, Sundays and designated holidays. You must obtain approval from the Engineer a minimum of 48 hours before scheduling any work in the hub building. The Engineer and the Caltrans electrical maintenance supervisor must be notified a minimum of 48 hours in advance before access is required to the Norwalk hub building.

The work performed in the hub building must take place in the presence of the Engineer and the LARTMC system engineer, telephone (213) 897-0329, or the Caltrans maintenance supervisor or any designee.

Access to the hub buildings must be strictly limited to the hours needed to complete that portion of work being performed within it. The work performed in the hub buildings must be done in such a manner so as to maintain the integrity of the room as neatly as possible. At all times, you must provide a clear walking path to all equipment in the hub buildings for the Department personnel's use.

You must protect existing equipment within the equipment room from damage from your operations. Access to hardware, electronics and peripheral equipment must be limited strictly to those items necessary for you to perform the work required.

You must cooperate with other contractors, vendors, and support personnel for ongoing systems work that may be in progress at the Norwalk hub building during the term of this contract.

### **86-2.23D Payment**

Not Used

### **Add to section 86-2:**

#### **86-2.24 WORK AT LOS ANGELES REGIONAL TRANSPORTATION MANAGEMENT CENTER (LARTMC)**

##### **86-2.24A General**

The work at the LARTMC, located at 2901 W. Broadway, Los Angeles, consists of installing 2 video decoder modules in the existing video concentrator chassis. Provide all connecting wires, and cables, and incidentals required to make the installed equipment at the LARTMC building fully operational.

### **86-2.24A(1) Testing**

You must test installed equipment per manufacturer specifications before installation. You must follow the following testing procedures during installation from end to end.

#### **86-2.24A(1)(a) System testing**

System testing must include test plan, pre-installation testing, acceptance testing, and final testing.

#### **86-2.24A(1)(b) Test plan**

Five copies of a plan for installation, configuration and testing must be developed and submitted within 30 working days for approval. This plan must detail method of installation, configuration and testing for equipment and the associated schedule of activities.

#### **86-2.24A(1)(c) Pre-installation testing**

Installed components must be tested before installation in the presence of the Engineer.

A physical inspection of furnished equipment must be performed for quality of workmanship free of manufacturing defects and documentation must be provided.

#### **86-2.24A(1)(d) Acceptance testing**

The acceptance testing must comply with the approved test plan include conducting acceptance tests and subsequent retests, and documentation of the test results.

Functional tests of complete system must demonstrate that the equipment satisfies the functional requirements of the specifications. The connectivity of each communication link must be demonstrated, including IP and all communication links from field devices to the LARTMC.

Functional test results must be documented and submitted for review and approval, no later than 2 weeks after completion of the acceptance tests and comments made during the approval stage must be incorporated in this documentation.

If any aspect of the functional tests is determined to have failed, all acceptance testing must cease, the cause of the failure must be determined and repairs must be made to the satisfaction of the Engineer. Acceptance testing must, at the discretion of the Engineer, be repeated from the start of functional tests. You must be responsible for any delay caused by replacement of noncompliant equipment.

#### **86-2.24A(1)(e) Final acceptance**

Final acceptance must not occur until you have complied with the following conditions:

1. Testing has been completed and the Engineer has approved the results.
2. Equipment manuals have been approved and submitted.
3. Connections that were changed to perform tests were restored and tested.

### **86-2.24B Materials**

#### **86-2.24B(1) Video Decoder Modules**

##### **86-2.24B(1)(a) General**

The video decoder module must be connected to the following equipment:

1. LARTMC designated switch via Cat-5E twisted pair Ethernet cable
2. Video Jackfield (patch panel) via coaxial analog video cable
3. Serial to IP server box via Serial cable using Category 5E twisted pair and pin-outs as per specifications from video decoder module serial ports and the Serial to IP server box serial ports

##### **86-2.24B(1)(b) Materials**

Video decoder module must be from the same manufacturer as the existing video concentrator. Video decoder module must be installed in the existing video concentrator to decode video and camera control signals that are transported over IP from CCTV field cameras. The video decoder module must be capable of supporting at least 8 cameras. The video decoder module must support H.264 and MPEG-4 standards.

The video decoder module must be IP multicast capable and must have BNC ports for video output and an associated serial port (TIA-232/TIA-422/TIA-485) for camera control. The video decoder module must support remote management and configuration of video decoders and serial interfaces via Telnet, https and SNMP version 2. The serial interface associated with each video output must be an integral part of the video decoder module and must be available in the same video concentrator.

Video decoder module:	
Network/ interface	Ethernet interface: Ethernet 10/100 Mbps port, 8P8C
	Video protocols: ITU H.264 (ISO MPEG-4 AVC Baseline), MPEG-4(SP), and MJPEG
	Resolution(D1/CIF/QCIF): NTSC 720x480, 352x240, 176x120 Frame rate/bit rate: Constant and variable to 30/25 fps 30 kbps to 6 Mbps Multi-Stream: Triple streaming up to , 30/25 fps Multiple video decoders per module
	IP Multicast capable
	Application interfaces: TCP/IP, UDP/IP, Hyper Text Transfer Protocol Secure (HTTPS), Telecommunications Network (Telnet)
	Serial asynchronous port: Interface protocol: TIA-232, TIA-422, TIA-485 with a data rate of 300 bps to 115 kbps
	Remote management: Telnet, http and https via browser
	Time synchronization: NTP/SNTP
	Environmental requirement

**86-2.24B(1)(b)(i) Cords and Cables**

Cable ties, wire mounting devices, nonmetallic cable strain relief, and fixed diameter clamps must be used in the controller cabinet and equipment rack. Wire management brackets must be used every 2 feet at the cabinets to route cable. Cables and wire management system components must avoid physical interference between cables and adjacent equipment, allow equipment to be removed from cabinets without physical interference and keep terminal blocks clearly visible.

**86-2.24B(1)(b)(ii) Equipment Manuals**

Manuals must provide all information necessary to operate, maintain, and repair all of the equipment installed by you. Manuals must include Master Item Index that describes the purpose of each manual and brief description to the directory. It must also reference equipment manuals as required for additional and support material. It must contain an overall description of the system and associated equipment and cables with illustrative block diagrams. This section must identify all equipment and cables in the system stating the exact module and option number that are employed in the system. Manufacturer contact information, technical data specification, parts lists, part description, and settings for every type of equipment or cable must be provided. Clearly describe any modification done on the equipment. Manuals must include fault diagnostic and repair procedures to permit the location and correction of faults to the level of each replaceable module. The manual must include procedures for preventive maintenance in order to maintain the performance parameters of the system, equipment and cables within the requirements of the specifications.

Equipment must conform to rules and regulations of the Federal Communications Commission (FCC).

Prototype equipment is not acceptable. Equipment must be off the shelf, of current standard production units manufactured by original equipment manufacturer, and must have been in production for a minimum of 6 months. Rebuilt, modified, or reconditioned equipment is not allowed.

Metal filler plates must be furnished to cover any unused channel slots or card slots for rack mounted equipment and card cage assemblies. Equipment installation must not affect the controller cabinet door normal operation.

## **86-2.24C Construction**

### **86-2.24C(1) Access to Los Angeles Regional Transportation Management Center**

Work in the LARTMC is limited to the hours between 6:00 a.m. and 4:00 p.m. Mondays through Fridays and between 7:00 a.m. and 3:30 p.m. on Saturdays, Sundays and designated holidays. You must obtain approval from the Engineer a minimum of 48 hours before scheduling any work in the hub building. The Engineer and the Caltrans electrical maintenance supervisor must be notified a minimum of 48 hours in advance before access is required to the LARTMC.

The work performed in the hub buildings must take place in the presence of the Engineer and the LARTMC system engineer, telephone (213) 897-0329, or the Caltrans maintenance supervisor or any designee.

Access to the building must be strictly limited to the hours needed to complete that portion of work being performed within it. The work performed in the hub building must be done in such a manner so as to maintain the integrity of the room as neatly as possible. At all times, you must provide a clear walking path to all equipment in the hub building for the Department personnel's use.

You must protect existing equipment within the equipment room from damage from your operations. Access to hardware, electronics and peripheral equipment must be limited strictly to those items necessary for you to perform the work required.

You must cooperate with other contractors, vendors, and support personnel for ongoing systems work that may be in progress at the LARTMC building during the term of this contract.

### **86-2.24D Payment**

Not Used

## **86-2.25 MODIFY COMMUNICATION SYSTEM**

### **86-2.25A General**

Modify communication system consists of:

1. Removing, relocating and disposing pull boxes, cables and conduits, of various sizes and types,
2. Installing:
  - 2.1 Closed circuit television camera system, including camera control circuits and accessories, CCTV wiring, including composite video cables, connectors and coaxial cables
  - 2.2 Fiber distribution units (FDU) to all CCTV camera locations, ramp metering systems and traffic monitoring stations and connecting wires and cables
  - 2.3 Conduits, innerducts, conductors and cables of various sizes and types
  - 2.4 Splice vault, pull boxes of various sizes and types
  - 2.5 Circuit breakers in service equipment enclosure
  - 2.6 Fiber optic splice enclosures inside existing or new splice vault
  - 2.7 Model 334-TV controller cabinet.
  - 2.8 Other required incidental equipment
3. Connecting existing or new conductors of various sizes and types, including composite video cables, coaxial cables, and single mode fiber optic cables (12SMFO, 36SMFO, and 48SMFO) cables, and incidentals to make the installed or connected equipment fully operational.

New equipment must be current standard production units and must have been in production for a minimum of 6 months.

You must arrange, at your expense, a technician qualified to work on communication system materials and equipment present at the time these materials and equipment are installed, modified, connected, or reconnected.

### **86-2.25B Materials**

Not Used

### **86-2.25C Construction**

Not Used

## **86-2.25D Payment**

Not Used

## **86-2.26 TEMPORARY WIRELESS CLOSED CIRCUIT TELEVISION SYSTEM**

### **86-2.26A General**

#### **86-2.26A(1) Summary**

Section 86-2.26 includes specifications for installing the temporary wireless CCTV system (WCS), maintenance, and removal as shown. The temporary WCS must provide video and control at various locations and utilize wireless communications to transmit video to the District 7 LARTMC.

The temporary WCS must consist of photovoltaic power supplies, IP digital camera system, Ethernet switch, POE injector, third generation cellular modem assembly, antenna, and pole.

#### **86-2.26A(2) Submittals**

You must submit a test plan and schedule to the Engineer for approval and must notify the Engineer 48 hours before performing any test.

#### **86-2.26A(3) Quality Control and Assurance**

##### **86-2.26A(3)(a) WCS Communication Test**

You will be provided all applicable network addresses by the Engineer. You must demonstrate the connectivity of the WCS system by performing the following tests from the LARTMC to each wireless camera locations, as shown in the plans:

1. Connect to each wireless modem using the manufactures management software. Demonstrate a minimum of 5 minutes continuously video connectivity.
2. Successfully retrieve an image from the video of each IP Digital CCTV.
3. You must supply the hardware, software and cabling required for performing the WCS communication test.

WCS communication test comprises test plan, pre-installation testing, acceptance testing, and final acceptance of the temporary wireless closed circuit system.

Test the wireless closed circuit system after installation in the presence of the Engineer.

##### **86-2.26A(3)(a)(i) Test Plan**

The test plan must detail the method of testing each equipment in the temporary wireless closed circuit system, and the associated schedule of test activities. The test plan must comply with the system testing specifications, manufacturer's recommended test procedures and industry standard practices.

##### **86-2.26A(3)(a)(ii) Pre-installation Testing**

Test all equipment and components prior to installation of the temporary wireless closed circuit system, and record test results.

##### **86-2.26A(3)(a)(iii) Acceptance Testing**

The acceptance testing must comply with the accepted test plan.

Perform functional tests of complete wireless closed circuit television system must satisfy the functional specifications. The connectivity of each communication link must be demonstrated including all communication links from wireless modem devices to the LARTMC.

Verify that the radio signals measured at the wireless modem device comply with the signal strength specifications required by the service provider.

Record all acceptance test results and incorporate all comments made during the acceptance testing stage.

If any aspect of the functional tests violates the specifications, cease all acceptance testing, determine the cause of the failure, modify connections and replace equipment. Acceptance testing must be repeated from the start of functional tests.

**86-2.26A(3)(a)(iv) Final Acceptance**

Final acceptance will occur after compliance with the following:

1. All test results have been accepted.
2. All connections that were changed to perform tests have been restored and tested.

**86-2.26C Materials**

**86-2.26B(1) Terminal Blocks**

Terminal block must be rated 600 V(ac), minimum, and have nickel-, silver-, or cadmium-plated brass binder head screw terminal.

Heavy duty terminal block must be rated at 20 A and have 12 position with No. 10 x 5/16-inch nickel-plated brass binder head screws and nickel-plated brass inserts. Each position must have 2 screw-type terminals. Terminal block must be barrier type with shorting bars in each of the 12 positions, and must have integral type marking strips.

Light duty terminal block must be rated at 5 A and have 12 positions with No. 6 x 1/8 inch binder head screws. Each position must have 1 screw-type terminal.

**86-2.26B(2) Ethernet Switch Type 6**

**86-2.26B(2)(ai) General**

Ethernet switch type 6 must be installed in NEMA enclosures.

All non-Ethernet equipment in field cabinets must be converted to Ethernet using compatible suitable terminal servers in the field cabinet to enable connection to the Ethernet switch Type 6 in the cabinet. Connections are to be done using Cat 5E network patch cables which must be manufacturer certified as TIA-568 standard compliant. Connectors at both ends of the Cat 5E patch cables must be 8P8C-type modular connectors using T568B termination. Appropriate length must be used for all cables with sufficient length to allow for cable organization using cable ties but cable lengths must not to exceed 328 feet.

Ethernet switch type 6 must have compatible AC or DC power supply which must comply with the following requirements.

<b>Power Supply</b>	
Electrical Requirement	Input Voltage: - 48 V(dc) to - 60 V(dc), or 110 – 240 V(ac)

Ethernet switches must be provided with compatible fiber optic or copper SFP modules to populate the SFP slots on the switches as required. The choice of fiber optic SFP module types must be determined based on the distance of the fiber link involved.

Ethernet switch Type 6 must, at a minimum, comply with the following specifications:

<b>Ethernet Switch Type 6</b>	
Ethernet Downlink Interface	At least 4 Ethernet 10/100 Mbps ports
Ethernet Uplink Interface	At least 1 gigabit uplink SFP slot
Copper Wire Uplink Interface	At least 2 copper wire based uplink connection (Bandwidth capacity be minimum of 5 Mbps at 3000 ft distance between two connected switches. Single pair copper wire link or multiple pairs bonded copper wire link be allowed to achieve above range and bandwidth requirement)
Application Interfaces	TCP/IP, UDP/IP, Hypertext Transfer Protocol (HTTP), SNMP v.2 and v.3
Additional Requirements	IP Multicast capable, IEEE 802.1Q standard VLAN Compatible to existing network and switch management and monitoring software
Environmental Requirements	Minimum Range of Operating Temperature: -25 to +160 °F Relative Humidity: From 10 to 90 percent noncondensing
Mechanical Requirement	Maximum Device Size: 19" perimeter Integrated mounting including either 4 keyhole screw mounts in 19" rack or mounting bracket using DIN rail

**86-2.26B(2)(b) Copper Small Form-Factor Pluggable (SFP) Modules**

Copper SFP modules for the Ethernet switch type 6 must be compatible with the Ethernet switch. Copper SFP modules must be of gigabit type 1000BASE-T, have a minimum temperature range of +25 to +180 degrees F and be compatible with Cat 5E patch cables with 8P8C-type modular connectors.

**86-2.26B(3) Digital Camera System**

**86-2.26B(3)(a) General**

The Digital Camera System must consist of the digital camera (DC), the camera enclosure and DC interconnect wiring.

**86-2.26B(3)(a)(i) 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.

**86-2.26B(3)(a)(ii) Quality Control and Assurance**

You must be responsible for all testing and documentation required to establish approval and acceptance of the production, installation, and operation of these materials and equipment. The following identifies the specific quality control requirements for this special provision:

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

You must carry out system integration testing to ensure that the video interface and camera interconnect wiring performs to the specified standards when used in operation with all other devices installed under the contract.

**86-2.26B(3)(b) Materials**

**86-2.26B(3)(b)(i) Digital Camera**

The digital camera (DC) must meet the following: (1) industrial grade, (2) high speed, (3) high sensitivity and ultra-high- resolution with a built-in web server, (4) built in FTP server, (5) IEEE 802.3af Power-Over-Ethernet ready, (6) have integrated bandwidth management, (7) have storage management and playback/recording capabilities.

The DC must incorporate a 750,000 pixel (minimum) progressive scan, CMOS imager device with a dichroic infrared mirror. The network addressable camera must produce a digital image resolution of no less than 780 (H) X 480 (V) pixels at no less than 30 images/second at full resolution. The zoom lens must have a focal length from 5 mm to 50 mm (with a 10:1 ratio). It must include manual focus with focus control and variable zoom.

The DC must have a minimum light requirement of approximately 0.3 lux with an f1.2 lens and must accommodate both C-mount and CS-mount style lenses. The camera must have automatic: (1) white balance, (2) exposure, (3) shutter speed and (4) gain control. The video output must be TCP/IP format using an 8P8C modular connector.

The DC must provide integrated support for IP, TCP, UDP, ICMP, FTP, SMTP, DHCP, HTTP, Telnet and communications and will have a text overlay and can be programmed. The camera must have at least 16 Mbyte of RAM and 4 Mbyte of flash and will use H.264 or MJPEG compression that can be viewed with a standard browser.

The DC must have a digital pan/tilt and zoom on video. All camera functionality must be available to users running versions of Java and versions of Netscape, Internet Explore or Firefox released after January 1, 2004.

The camera must require no unique or proprietary client software for viewing or controlling the cameras. The camera can be user configurable and the administrator can functionally or aesthetically modify the web pages.

The DC must have an Ethernet connection and a removable power connector that has captive screw terminals for holding the wires and captive screw terminals for holding the connector to the camera.

The camera must also include a mechanical factory default reset button.

The DC must not exceed a dimension of 13.8" (H) x 10" (W) x 11" (D) and weigh no more than 14 ounces excluding the camera mount and lens. Power requirements for the video camera must from 115 V(ac) or 24V(ac) and must consume no more than 28W

The video camera must be constructed of a durable material and must be magnetically and electrostatically shielded. The camera must feature solid-state components to resist shock and vibration and have no moving parts.

In addition to the requirements above the digital camera must meet the following additional minimum performance requirements:

Backlight Compensation	User configurable exposure window
Recording Media	External network storage.
Image file format	JPEG & MJPEG & H.264 for viewing from Firefox, Internet Explorer or Netscape
Transmission Encryption	MD5 Hashing
Password Levels	User and Administrator
Operating Conditions	Temperature: -0 to 104 °F Humidity: 10 to 90 PERCENT, no condensation
Camera Mount	1/4" - 20 UNC (top and bottom)
Braking: Pan And Tilt	Mechanical or Electrical to limit coast
Overload Protection	Motors: Impedance protected
Angular Travel	Pan: From 20 to -90 degrees horizontal, Continuous
Pan Speed	From 0.1 to 80 degrees/s variable-speed
Tilt Speed	From 0.1 to 40 degrees/s variable-speed
Pan And Tilt Position Preset	Positions camera to a predetermined azimuth, elevation and lens

### **86-2.26B(3)(b)(ii) Camera Enclosure**

The camera enclosure that houses the digital camera (DC) must be sealed and pressurized with dry nitrogen. Camera housing to protect the camera from excess thermal loading and meet the following:

#### A. Mechanical:

1. Weight: 15pounds.

#### B. Environmental:

1. Ambient Temperature Limits (Operating) must be from -40 to 165 degrees F
2. Ambient Temperature Limits (Storage) must be from -22 to 185 degrees F
3. Humidity range up to 100 percent relative humidity.
4. Withstands exposure to sand, dust, fungus, and salt atmosphere

### **86-2.26B(3)(b)(iii) Digital Camera Interconnect wiring**

The DC Interconnect Wiring must be installed as described and as recommended by the manufacturer.

Connectors must be in accordance with manufacturer's recommendation.

Interconnect wiring and connectors must be supplied and installed to make the DC subsystem completely operational.

### **86-2.26B(3)(c) Construction**

Wiring must run continuous from source to destination without splices.

Cables must be installed without damaging the conductors, insulation, or jacket and the cables must not be kinked or bent tighter than the manufacturer's recommended bending radius.

Sufficient slack must be provided for equipment movement. The cable must be secured and protected from physical damage.

The control cable must be routed from the Digital Camera on the camera pole to the pole mounted enclosure. A ground wire must be provided between the Digital Camera and the camera pole.

### **86-2.26B(3)(c) Payment**

Not Used

## **86-2.26B(4) Photovoltaic (PV) Power Supply**

### **86-2.26B(4)(a) General**

#### **86-2.26B(4)(ai)(i) Summary**

The Photovoltaic (PV) Power Supply for WCS must consist of components designed for outdoor use and approved by the Underwriters Laboratory.

Each PV Power Supply for WCS must include a panel support structure, photovoltaic panels, batteries, a load/charge controller, a NEMA enclosure and it's components as shown on the plans and in conformance with these special provisions.

Each PV power supply for WCS must be designed to provide 12 V(dc) to the WCS 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 WCS System 24 hours per day. A panel support structure must be furnished and installed to securely fasten the PV panels to the wireless CCTV system standard as shown.

The PV power supply for WCS must be designed to operate in ambient air temperatures from –10 to +60 degrees C. Each PV power supply for WCS must include the following items:

Item	Quantity
Panel Support Structure	1
Photovoltaic Panels	2
Batteries	3
Load/Charge Controller	1
NEMA Enclosure	1

**86-2.26B(4)(b) Materials**

**86-2.26B(4)(b)(i) Panel Support Structure**

The panel support structure must hold the PV Panels securely on the wireless CCTV system standard as shown. The PV panels must be oriented as per the manufacturer's recommendation to maximize the collection of solar energy. Engineering drawings must be submitted indicating that the PV panels are mounted on a system that is designed to withstand the maximum wind loads based on a fastest-mile basic design wind speed of 80 mph or that they are designed to withstand the maximum wind loads based 3-second-gust basic design wind speed of 100 mph.

**86-2.26B(4)(b)(ii) Photovoltaic Panels**

Each Photovoltaic (PV) Panel must meet the following requirements:

Photovoltaic Panel	
Parameter	Requirements
Peak Power Output * (watts)	137**
Voltage at Maximum Power V(dc)	17.95**
Current at Maximum Power (A)	8.75 **
Weight (lbs)	27**
Approximate Dimensions (inches)	62 L x 27 W x 2.2 D **
Hailstone Impact Resistance at 22.22 mph (inches)	1
Operating Temperature Range (°C)	-10 to +65minimum

\* Standard Test Conditions identified a: Irradiance = 1000 W/square meter, cell temperature = 25 degrees C, solar spectral irradiance per ASTM E892 (air mass = 1.5 )

\*\* Minimum Requirements are based on a 130 watt PV Panel. Higher wattage PV Panels up to and including Peak Power Output of 137 watts are acceptable. The PV Panels must contain single crystal or multi crystal technology for greatest efficiency and longest life. The cells must be textured and coated with an anti reflective film. These cells must be provided with multiple redundant contacts and must be electrically matched for increased efficiency. A rugged aluminum vented backing must be riveted to a aluminum panel equipped with welded aluminum brackets for attachment to the bracket arm. The PV Panel assembly must pass salt tests to Mu-standard 810 and the panel assembly must provide electrical grounding of all metal surfaces. The PV Panel must carry a minimum 20 year power warranty. Stainless steel hardware must be used.

**86-2.26B(4)(b)(iii) Batteries**

Batteries must be maintenance free, sealed, Absorbed Glass Mat, deep cycle, heavy duty and must meet the following requirements:

<b>Batteries</b>	
Parameter	Requirements
Nominal Voltage V(dc)	12.6
Storage Capacity at a 100 hour discharge rate (Ampere-Hour minimum)	130
Maximum Weight	Not to exceed 75 lbs each

They must be identical in make and model. All connections must be marine grade. The batteries must be interconnected in parallel to provide 12.6 V(dc). Interconnections must be made with molded 3 prong plugs, provided as a power output connection and battery disconnect. An ATO water resistant fuse holder and specified for the given model system must be included. The battery must be 100 percent recyclable and capable of a minimum of 1000 cycles in this application.

**86-2.26B(4)(b)(iv) Load Charge Controller**

Each Load Charge Controller must regulate the voltage and current coming from the solar panels going to the batteries and to the load (WCS components).

Each Load Charge controller must meet the following minimum requirements:

<b>Load Charge Controller</b>	
Parameter	Minimum Requirements
Rated Solar Current (A)	15
Rated Load Current (A)	15
System Voltage V(dc)	12 / 24
Digital Meter	Displays Battery Voltage, Solar Current and Load Current
Connections	Screw terminals for Solar PV Panels, Battery and Load
LED Indicators	Charging, Battery Status and Temperature
Load Disconnect Switch	Solar
Self-test	Tests all Load/Charge Controller internal circuits.

**86-2.26B(4)(b)(v) Nema Enclosure**

The enclosure must be a NEMA Type 3R with dimensions as shown. Enclosure must house the batteries and other equipment as shown. Overlapping exterior seams and doors must comply with requirements for NEMA 3R enclosures in the NEMA Enclosure Standards.

**86-2.26B(4)(c) Construction**

Not Used

**86-2.26B(4)(d) Payment**

Not Used

**86-2.26B(5) THIRD GENERATION CELLULAR MODEM ASSEMBLIES**

**86-2.26B(5)(a) General**

**86-2.26B(5)(a)(i) Summary**

Section 86-3.08 includes specifications for installing the third generation (3G) cellular modem assembly at the controller cabinet.

## **86-2.26B(5)(b) Definitions**

Not Used

## **86-2.26B(5)(c) Submittals**

Submit warranty documentation before installation.

## **86-2.26B(5)(d) Quality Control and Assurance**

### **General**

Not Used

### **Quality Control**

Develop detailed test procedure that includes required equipment, prior to testing. Perform testing after the test plan is approved. The testing must be observed by the Engineer and the final recorded results approved.

Perform a loop back test at the installation site. For the loop back test transmit data from the central computer to the modem with an external loopback connector and monitor the resulting return data. Transmit 50 bytes, every 30 seconds, for a 24 hour period. Test both TCP and UDP protocols. TCP must have no data lost. UDP may have up to 2 percent data lost. No corrupted data is allowed.

Perform an extended video transport test at the installation site. Transmit MJPEG and H.264 encoded SMPTE-170M video continuously for one full hour each. Test resolutions from 320 by 240 to 640 by 480. Test frame rates from 3 to 30 frames per second. Test using the streaming protocols supported by the encoder or camera. There must be no more than 2 percent lost or corrupted frames. No single dropout may exceed 1 second. There must be no more than 5 dropouts in one hour. Identify all combinations of frame rate and resolution not meeting requirements.

## **86-2.26B(5)(b) Materials**

### **86-2.26B(5)(b)(i) General**

The 3G cellular modem assembly consists of a modem, power supply, mounting bracket and hardware, serial communication cable, and antenna.

### **86-2.26B(6)(b)(ii) Modems**

The modem must:

1. Provide both serial local port and 10/100 Ethernet local port.
2. Be configurable either remotely through the wireless network or through either local port.
3. Have a full duplex transceiver.
4. Have an integrated transmission control protocol/internet protocol (TCP/IP) stack with user datagram protocol (UDP).
5. Have a user-settable password to prevent unauthorized access.
6. Include a DC power cable at least 3 feet long with a connector compatible with the modem power connector.
7. Have a choice of "Friends Only" access mode.
8. Comply with TIA-678.
9. Have an operating temperature range from -30 to 70 degrees C with humidity from 5 to 95 percent (non-condensing).
10. Have transmissions at 10 percent duty cycle above 60 degrees C.
11. Weigh less than 2 lb.
12. Have a housing constructed of anodized aluminum with overall dimensions of less than 7-1/8 by 3-1/2 by 1-1/8 inches.
13. Have the following status indicators:
  - 13.1. Power on
  - 13.2. Channel acquired
  - 13.3. Link status
  - 13.4. Network registration
  - 13.5. Received signal strength indicator
  - 13.6. Transmit and receive data
  - 13.7. Block errors

14. Operate in a static or dynamic IP addressing environment of 3G cellular on all authorized bands.
15. Have standard interfaces for:
  - 15.1. Host communicates control and configuration with modem using either UDP or TCP packet modes.
  - 15.2. Computer terminal platform using dial-up networking communicates with the modem using point to point protocol (PPP).

The modem and associated firmware, software, hardware, protocol, and other features must be fully compatible with the existing 3G cellular network. The modem must be capable of using older modes of HSPA, EDGE, GPRS, and TIA-627 (cdmaOne) as required.

The existing service provider uses the compatible 3G cellular system and the AirLink Gateway.

**86-2.26B(5)(b)(iii) Power Supply**

The power supply must:

1. Be vertically mountable on a 19-inch standard rack rail using two machine screws and two wing nuts.
2. Have provisions to attach the modem power cable securely without the modifying the cable.
3. Have a Standard 120 V(ac), 3 prong cord, power cord at least 3 feet long.
4. Be of switching type and over 95 percent efficiency under normal operation.
5. Comply with UL 1012 and UL 60950.
6. Meet the requirements shown in the following table:

**Power Supply Requirements**

Quality Characteristics	Requirement
Power rated with no minimum load required (W)	40
Input voltage range: (V(ac)) (V(dc))	85–264 120–370
Input frequency range (Hz)	47–63
Inrush current at 115 V, cold start (A)	25
Output voltage range (V(dc))	12 ± 1.2
Overload protection range in output pulsing mode (%)	105–150
Over voltage protection range of output voltage (%)	115–135
Time at 115 V(ac) to: (ms)	
Setup	800
Rise	50
Hold up	15
Withstand voltage for 60 s: (kV)	
I/P-0/P	3
I/P-FG	1.5

**86-2.26B(5)(b)(iv) Mounting Bracket and Hardware**

The mounting bracket must:

1. Be stainless steel.
2. Hold the modem in a vertical position with cables and conductors installed.
3. Contain the modem using a method that allows the removal of the modem without tools or without removing the bracket from its attachment to the cabinet frame.

**86-2.26B(5)(b)(v) Serial Communication Cables**

If the modem is designed to interface with a Department-furnished Model 170E/2070L controller, provide a C2 cable. The C2 cable interfaces the controller C2 connector and the 3G cellular modem and includes conductors and connectors required for that purpose. The 3G cellular modem cable connector must comply with TIA-423 standard using a 9-pin D shell subminiature connector. Pins in both connectors must be gold plated. The cable must have four no. 20 AWG conductors with Type CM shielded or AWM 2464 80C 300 volts. The cable must be at least 3 feet long. The cable wiring must comply with:

1. AMP 201360-2-ND -L to DE9-P - 2
2. AMP 201360-2-ND -K to DE9-P - 3
3. AMP 201360-2-ND -N to DB9-P - 5
4. AMP 201360-2-ND -D to AMP 201360-2-ND - H
5. AMP 201360-2-ND -J to AMP 201360-2-ND - M

**86-2.26B(5)(b)(vi) Antenna**

The antenna must:

1. Be the low profile disc type and adhere to the cabinet using a factory installed double-sided waterproof acrylic foam adhesive.
2. Have an integral coaxial cable at least 3 feet long with a 50 Ω TNC connector on the modem end.
3. Be omni-directional in the horizontal plane.
4. Have vertical polarization.
5. Meet the requirements as shown in the following table:

**Antenna Requirements**

Quality Characteristic	Requirement
Voltage standing wave ratio (VSWR) at resonant point	2:1 or less
Frequency range (MHz)	On authorized cellular bands to match modem and service provider
Nominal impedance (Ω)	50
Gain (dB)	2

**86-2.26B(5)(c) Construction**

Install the modem under the manufacturer's instructions. Install the antenna with a ground plane that extends 8 inches in all directions.

You may adjust the modem Installation for field conditions if authorized.

Configure the modem before acceptance.

Demonstrate the compatibility to the Engineer by actual installation or by other authorized means.

Provide the Engineer with the modem serial, SIM and international mobile equipment identification (IMEI) numbers 30 days before requiring the packet data protocol (PDP) context. The Engineer will provide the PDP context comprising of the assigned IP and access point name (APN) obtained from service provider.

**86-2.26B(5)(d) Payment**

Not used

**86-2.26B(6) Power over Ethernet Injector**

**86-2.26B(6)(a) General**

Power over Ethernet (PoE) injector must be installed in NEMA enclosure.

PoE injector must comply with the following:

<b>PoE Injector:</b>	
Electrical requirement	Input voltage: 10 - 26 V(dc) Output voltage: 15.4W
Additional Requirements	Category 5e cabling
	IEEE 802.3af-2003 complaint
	Two 10/100/1000 Ethernet ports
	Compatible to existing network and switch management and monitoring software
	Power connector: multiple pin (screw attached terminal not recommended)
Environmental requirement	Operating temperature: -22 to +165 °F Humidity: From 10 to 90 percent non-condensing
Mechanical requirement	Maximum device size: 19" perimeter

### 86-2.26B(7) Terminal Server

#### 86-2.26B(7)(a) General

Terminal server must be installed in the LARTMC to enable it to communicate over the IP network.

Terminal server must able to connect to two serial devices via two serial ports and provide an IP address and a port for a socket connection for each device, available over Ethernet/IP network using a 10/100 8P8C Ethernet port.

Terminal server must meet the following requirements.

<b>Power Supply</b>	
Electrical Requirement	Input Voltage: 12V(dc), 24V(dc) or 110-240 V(ac) Power: external adapter with same extended temperature range, 9-30VDC @ 0.5 Amps max

Terminal server must, at a minimum, meet the following specifications:

<b>Terminal Server</b>	
Ethernet Interface	One 10/100base-T 8P8C Ethernet port
Serial Interface	Two Switch-selectable TIA-232/422/485 8P8C serial ports, baud rate up to 230 kbps
Application Interfaces	TCP/IP, UDP/IP, Hypertext Transfer Protocol (HTTP), Telecommunications Network (Telnet)
Additional Requirements	Modem emulation
Environmental Requirements	Operating Temperature: -30 to +160 °F Humidity: From 10 to 90 percent non-condensing
Mechanical Requirement	Maximum Device Size (L x W x H): 7" x 2" x 4"
Computing Platform Requirement	Operating system compatibility: device drivers for HPUX 11v3, Linux, Microsoft Windows Server 2003, Microsoft Windows XP Professional. Applications: unlimited virtual TTY devices (for HPUX and Linux) and virtual serial communication ports (for Microsoft Windows).

### 86-2.26B(8) Router Type 2

#### 86-2.26B(8)(a) General

Router type 2 must be installed in LARTMC

Router type 2 must comply with the following:

<b>Router type 2:</b>	
Electrical requirement	Input voltage: 110 - 240 V(ac)
Network/ Interface	Ethernet downlink Interface: At least 1 interface slot to install a 4-port Gigabit Ethernet 10/100/1000 Mbps LAN switch module 1 compatible 4-port Gigabit Ethernet LAN switch module installed Integrated Gigabit Ethernet WAN ports: 3
	Wan Interface Card Slots (WIC): At least 3 WIC slots that support T1 module
	1 compatible 4-port T1 WIC module with CSU/DSU, RJ-48C ports installed in one of the WIC slots T1 mode, T1 interface loopbacks, framing (Sf and ESF), and line codes (AMI, B8ZS) LEDs for data carrier detect, loopback, and alarm
	Layer 3 support for IP Routing
	IP multicast capable, IEEE 802.1Q standard VLAN
	Application interfaces: TCP/IP, UDP/IP, Hyper Text Transfer Protocol (HTTP), Telecommunications Network (Telnet)
	Compatible to existing network and switch management and monitoring software
	Power connector: multiple pin (screw attached terminal not recommended)
Environmental requirement	Operating temperature: 32 to +104 °F Humidity: From 10 to 90 percent non-condensing
Mechanical requirement	Maximum device size: 19" perimeter Mounting for 19" rack

**Add to section 86-3.02A(2):**

Submit the manufacturer's warranty documentation before installing the batteries.

**Add to section 86-3.02A(3):**

Batteries must have a 5-year manufacturer's warranty against defects in materials and workmanship. The warranty period starts on the date of Contract acceptance. Provide replacement batteries within 5 business days after notification of failed batteries. The Department pays to ship the failed batteries. Deliver replacement batteries to the District Maintenance Electrical Shop at:

7316 E Bandini Blvd.,  
Commerce,  
CA 90040  
Tel (213) 620-2194

**Add to section 86-3.02B:**

The external cabinet must be capable of housing:

1. 8 batteries
2. Inverter/charger unit
3. Power transfer relay
4. Manually-operated bypass switch
5. Required control panels
6. Wiring and harnesses

**Replace the 3rd, 5th, and 7th paragraphs of section 86-3.02B with:**

Dimensions and details for the external cabinet, for attaching the external cabinet to the Model 332 cabinet, and for wiring the Department-furnished equipment are available as shown.

The external cabinet must be ventilated by using louvered vents, a filter, and a thermostatically controlled fan. The fan must be AC-operated from the same line output as the Model 332 cabinet. Provide 10 feet of connected hookup wire and a 2-position terminal block on the fan panel.

The external cabinet must include all bolts, washers, nuts, and cabinet-to-cabinet coupler fittings necessary for mounting it to the Model 332 cabinet.

**Replace the RSS for section 86-3.02B with:**

The couplings for the external cabinet and Model 3 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

**Replace the paragraph in section 86-3.02C with:**

Mount the external cabinet to either the left or right side of the Model 332 cabinet. The typical side-mounting location of the external cabinet is flush with the bottom of the Model 332 cabinet and approximately equidistant from the edges of the front and rear doors.

**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.

Model 334L controller cabinet for RMS and TMS use the following:

1. Service panel no. 1
2. Power distribution assembly no. 3
3. Input file (I file)
4. C1 harness
5. Controller and equipment shelves
6. Dual fan assembly with thermostatic control
7. Mechanical armature-type relays
8. Input panel

Model 334-TV controller cabinet for use the following:

1. Power distribution assembly no. 1
2. Equipment shelves
3. Dual fan assembly with thermostatic control

Before shipping to the job site, submit each Model 334L and Model 334-TV controller cabinets to METS for acceptance testing.

Notify the Engineer when each Model 334L and Model 334-TV controller cabinets are ready for functional testing. Functional testing will be conducted by the Department.

Each power distribution assembly must include the following equipment:

1. Two duplex NEMA 5-15R controller receptacle (rear mount)
2. One 30 A, 1-pole, 120 V(ac) main circuit breaker
3. Three 15 A, 1-pole, 120 V(ac) circuit breaker
4. One duplex GFCI NEMA 15 A, receptacle (front mount)

For RMS and TMS controller cabinet, furnish 1 shelf as shown.

For Model 334-TV controller cabinet use the following:

Furnish 2 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.

For RMS and TMS controller cabinet use the following:

Furnish 2 terminal blocks as shown. Terminal blocks must comply with Chapter 6 of TEES, except the screw size must be 8-32.

For Model 334-TV controller cabinet, no terminal blocks to be furnished.

For RMS and TMS controller cabinet use the following:

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.

For Model 334-TV Controller Cabinet use the following:

Furnish a maintenance manual or a combined maintenance and operation manual for video encoder, layer 2 switch, and auxiliary equipment. 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 86-3:**

**86-3.05 TRAFFIC SIGNAL INTERCONNECT SYSTEM**

**86-3.05A General**

**86-3.05A(1) Summary**

Section 86-3.05 includes functional specifications for modem module and its connection to controllers, terminal blocks and signal interconnect cable(s).

The Department will furnish the C2P modem interconnect harness listed in section 6-2.03.

**86-3.05A(2) Definitions**

**CTNET:** Traffic signal management and surveillance system for Model 170E controllers using AB3418/AB3418E protocol.

**signal system master controller:** Field master controller unit used to interface transportation management center and traffic signal controllers.

**traffic signal controller:** Local controller unit used to control traffic signal intersection or pedestrian crosswalk.

**TSMSS:** Traffic signal management and surveillance system for Model 2070 controllers using AB3418/AB3418E or NTCIP protocols.

**Testing location:** It is located at Mail Stop 15, Quality Coordinator Branch, California Department of Transportation, Office of Traffic Design, 100 South Main Street, Room 04-031 (Signal Lab), Los Angeles, CA 90012. Contact Engineer for telephone number.

### **86-3.05A(3) Submittals**

Within 15 days of Contract approval, submit manufacturer's technical specification and certificate of compliance of modem module for review and acceptance.

Deliver traffic signal interconnect system equipment for testing to the testing location.

### **86-3.05A(4) Quality Control and Assurance**

Prototype equipment is not acceptable. Equipment must be off the shelf, must be of current standard production units manufactured by original equipment manufacturer, and must have been in production for a minimum of 6 months. Rebuilt, modified, or reconditioned equipment is not allowed.

The traffic signal interconnect system equipment must be compatible with traffic signal controllers specified in Department TEES and with existing traffic signal management and field software. No modification must be required from existing hardware and software.

Satisfactory system operation includes successful 2-way communications between signal system master and all interconnected traffic signal controllers, and verification that the signal system master controller receives AB3418E status response messages sent by traffic signal controllers.

### **86-3.05B Materials**

Furnish modem module, and cable and wire management components.

Equipment must comply with the latest TEES and the following:

1. Modem module must comply with the specifications for Model 400B modem module specified in chapter 2-section 3 "Model 400, 400B, and 400BE Modem Module," of the TEES, and must support 9600 baud rate communications with Model 2070-6B modems. Modem module must support field to field communications between the signal system master and traffic signal controllers. Modem module must interface to a signal system master using Model 170E controller with Department Traffic Responsive Field Master (TRFM) software.
2. Cable and wire management components include cable ties, wire and cable mounting devices, non-metallic strain reliefs, fixed diameter clamps, and wire management brackets.

### **86-3.05C Construction**

After successful testing results, install the traffic signal interconnect system.

Notify the Engineer at least 3 business days prior to installation.

Equipment installation must not affect the normal activity of the controller cabinet's doors. Use wire management brackets every 1 foot in the cabinets to route cable. Use cables and wire management system components in the controller cabinet and equipment rack to avoid physical interference between cables and adjacent equipment, to allow equipment to be removed from controller cabinet without physical interference, and to keep terminal blocks clearly visible.

Comply with the manufacturer's installation instructions and recommendations to avoid equipment damage during installation. Install modem module in modem slot 1 of Model 170E controller in the controller assembly and connect it to terminal block TB0 using port C2S in controller and Department-furnished C2P modem interconnect harness.

Signal system master and traffic signal controllers must be interconnected as follows:

TB-0 Terminal Block Connect or	Traffic Signal Controller		Signal System Master Controller	
	C2S Port Function	C2S Port Pin	C2S Port Function	C2S Port pin
A1	Audio IN	A	--	--
A2	Audio IN	B	--	--
A3	Audio OUT	C	--	--
A4	Audio OUT	E	--	--
A1	--	--	Audio OUT	C
A2	--	--	Audio OUT	E
A3	--	--	Audio IN	A
A4	--	--	Audio IN	B

Signal system master controller audio out is connected to traffic signal controller audio in and signal system master controller audio in is connected to traffic signal controller audio out. You must label Department-furnished C2P modem interconnect harness with port function audio out or audio in if labeling is not furnished with Department-furnished C2P modem interconnect harness.

**86-3.05D Payment**

Not used

**Add to section 86-3:**

**86-3.06 WIRELESS DATA SERVICE**

**86-3.06A General**

**86-3.06A(1) Summary**

Section 86-3.06 includes specifications for installing the wireless data service in the controller cabinet.

**86-3.06A(2) Definitions**

**CTNET:** Traffic signal management and surveillance system for Model 170E controllers using AB3418/AB3418E protocol.

**HSPA:** High speed packet access. Third generation (3G) wireless data service.

**LARTMC:** Los Angeles Regional Transportation Management Center.

**signal system master controller:** Field master controller unit used to interface transportation management center with traffic signal controllers.

**TSMSS:** Traffic signal management and surveillance system for Model 2070 controllers using AB3418/AB3418E or NTCIP protocols.

**testing location:** It is located at Mail Stop 15, Quality Coordinator Branch, California Department of Transportation, Office of Traffic Design, 100 South Main Street, Room 04-031 (Signal Lab), Los Angeles, CA 90012. Contact Engineer for telephone number.

### **86-3.06A(3) Submittals**

Submit signal strength measurements report for acceptance.

Submit certificates of compliance and warranty documentation before installation.

### **86-3.06A(4) Quality Control and Assurance**

Satisfactory system operation includes successful two-way communications between signal system master and wireless modem device and between CTNET/TSMSS and wireless modem device.

### **86-3.06A(5) Warranty**

Furnish a 1-year replacement warranty from the manufacturer of the modems and power supplies against any defects or failures. The effective date of the warranty is the date of installation. Furnish replacement modems and power supplies within 5 days after receipt of the failed parts. The Department does not pay for the replacement parts. Deliver replacement modems and power supplies to the testing location.

### **86-3.06B Materials**

#### **86-3.06B(1) General**

The wireless data service system consists of a wireless modem device, wireless modem AC adaptor , wireless modem mounting hardware, wireless modem serial cable, wireless modem antenna, wireless modem software tool, low loss adapter, cable and wire management components and sealant.

The wireless data service system must be compatible with traffic signal controllers specified in Department TEES and with existing traffic signal management and field software. No modification must be required from existing hardware and software.

#### **86-3.06B(2) Wireless Modem Device**

The wireless modem device must:

1. Be configurable remotely through the wireless network and locally through the wireless modem device serial port
2. Be configured before acceptance.
3. Have a minimum 53.6 Kbps raw data transfer rate.
4. Have a full duplex transceiver.
5. Have 1900/850 MHz dual band networking.
6. Have an integrated TCP/IP stack with user datagram protocol (UDP).
7. Have a user-settable password to prevent unauthorized access.
8. Include a DC power cable at least 3 feet long with a connector compatible with the wireless modem device power connector.
9. Have a packet buffering and forwarding feature that provides discipline to the output of the serial port. The packet forwarding time interval must be configurable from a rate of 0 (undisciplined) to 400 ms in increments of 100 ms or less.
10. Have a choice of "Friends Only" access mode.
11. Comply with TIA-678.
12. Have an operating temperature range from -30 to +70 degrees C with humidity from 5 to 95 percent (non-condensing) and have transmissions at 10 percent duty cycle above 60 degrees C.
13. Weigh less than 2 lb and have overall dimensions of less than 7-1/8 by 3-1/2 by 1-1/8 inches. The housing must be constructed of anodized aluminum.
14. Have the following status indicators:
  - 14.1. Power on
  - 14.2. Channel acquired
  - 14.3. Link status
  - 14.4. Network registration
  - 14.5. Received signal strength indicator
  - 14.6. Transmit and receive data
  - 14.7. Block errors
15. Operate in a static IP addressing environment of GPRS networks at 1900/850 MHz and meet the operational parameters shown in the following table:

(Operational parameter)	Requirements)
Receiver sensitivity	-107 dBm (2.439 % bit error rate)
Input voltage	10 to 28 V (dc)
Input current	40 to 200 mA

16. Have the following standard interfaces:

- 16.1. Remote host communicates with wireless modem device using either UDP or TCP packet modes.
- 16.2. Local host uses terminal mode or dial-up networking to communicate with the wireless modem device.

The wireless modem device and associated firmware, software, hardware, protocol, and other features must be fully compatible with the existing network. Demonstrate the compatibility to the Engineer by actual installation or by other authorized means.

The existing service provider uses GPRS compatible network.

#### **86-3.06B(3) Wireless Modem AC Adaptor**

The wireless modem AC adaptor must be an accessory provided by the wireless modem device manufacturer.

#### **86-3.06B(4) Wireless Modem Mounting Hardware**

Wireless modem mounting hardware must include 4 self-tapping screws and washers that match the keyhole screw mounts or mounting bracket of the wireless modem device.

The mounting bracket must:

1. Be stainless steel.
2. Securely hold the wireless modem device in a vertical position with all cables and conductors installed.
3. Contain the wireless modem device using a method that allows the removal of the wireless modem device without tools or without removing the bracket from its attachment to the cabinet frame.

#### **86-3.06B(5) Wireless Modem Serial Cable**

The wireless modem serial cable interfaces the controller to the wireless modem device and includes all conductors and connectors required for that purpose. The connector for the wireless modem device must comply with TIA-232 standard using a 9-pin D shell miniature connector. The C2 connector for the Department-furnished controller must comply with AMP 201360-2 or equivalent. All pins in both connectors must be gold plated. The cable must have eight no. 20 AWG conductors with (UL) Type CM shielded or AWM 2464 80C 300 Volts. The cable must be at least 3 feet long. The cable wiring must comply with the following:

1. AMP 201360-2-ND -H to DE9-P - 1
2. AMP 201360-2-ND -L to DE9-P - 2
3. AMP 201360-2-ND -K to DE9-P - 3
4. AMP 201360-2-ND -N to DB9-P - 5
5. AMP 201360-2-ND -J to DE9-P - 7
6. AMP 201360-2-ND -M to DE9-P - 8
7. DE9-P - 4 to DE9-P - 6

#### **86-3.06B(6) Wireless Modem Antenna**

The wireless modem antenna must:

1. Be low profile design for outdoor surface bolt mount on aluminum, stainless steel and cold rolled steel metallic surfaces. The coax cable must be at least 3 feet long and have a 50  $\Omega$  connector that matches the wireless modem device antenna connector.

2. Meet the requirements as shown in the following table:

(Parameter	Requirements)
VSWR (at resonant point)	2:1 or less
Frequency	Cellular: 1850-1990 MHz and 824-894 MHz GPS Center Frequency: 1575.42 MHz.
Nominal impedance	50 $\Omega$
Gain	2 dB
Radiation pattern	Omni-directional
Polarization	Vertical

**86-3.06B(7) Wireless Modem Software Tool**

Wireless modem software tool must include user's manual, software resident on wireless modem device, software site license and application software. The software tool must support remote access through device ports and over the air interface. The wireless modem software tool must support local and remote management, control, configuration, firmware upgrades, diagnostics, monitoring of signal level at receiver, and reset of the wireless modem device. The user's manual and system manual must describe the function of all configuration parameters accessed by the wireless modem software, describe default values, and provide valid range or values for all configuration settings. You must furnish compact discs containing application software and Internet browser software compatible with software resident on wireless modem device.

**86-3.06B(8) Low Loss Adapter**

Low loss adapter must be a SMA socket to BNC plug low loss in-line straight adapter. Low loss adapter must comply with the following requirements:

Nominal Impedance	50-Ohm
Operating Frequency Range	0 to 2 GHz
Maximum VSWR	1.2
Maximum Insertion Loss	0.1 dB
Operating Temperature	-22 to +176 °F
Body Finish	Gold or Nickel plated
Contacts Finish	Gold plated
Body Materials	Beryllium Copper or Brass

**86-3.06B(9) Cable and Wire Management Components**

Cable and wire management components include cable ties, wire and cable mounting devices, non-metallic strain reliefs, fixed diameter clamps, and wire management brackets.

**86-3.06B(10) Sealant**

Sealant must be UL listed heat resistant, weatherproof, waterproof, watertight and high temperature silicone sealant, withstand -45 to +200 degrees F, and resist vibration.

**86-3.06C Construction**

You may adjust the wireless modem device installation for field conditions if authorized.

Equipment installation must not affect the normal movement of the controller cabinet's doors. Use wire management brackets every 1 foot in the cabinets to route cable. Use cables and wire management system components in the controller cabinet and equipment rack to avoid physical interference between cables and adjacent equipment, to allow equipment to be removed from controller cabinet without physical interference, and to keep terminal blocks clearly visible.

Comply with the manufacturer's installation instructions and recommendations to avoid equipment damage during installation. Wireless modem device must be mounted using wireless modem mounting hardware, connected to port C20S of Model 170E controller used as signal system master, connected to SMA Cellular network connector of wireless modem antenna, and connected to wireless modem AC

adaptor. Wireless modem antenna must be surface mounted, connected to the wireless modem device, and connected to a GPS time source device using the low loss adapter or to a Model 2070-7G module using the antenna's GPS SMA plug straight connector. Wireless modem AC adaptor must be connected to an equipment outlet, not to a controller outlet, in the power distribution assembly (PDA) and to the wireless modem device.

Use a serial cable, a laptop computer, the wireless modem software tool, and the wireless modem device to measure signal strength. Before wireless modem antenna is permanently installed, conduct signal strength measurements and add measurements to signal strength measurements report. After acceptance of the signal strength measurements report, install the wireless modem device, the wireless modem mounting hardware, the wireless modem AC adaptor, and the wireless modem serial cable. The wireless modem mounting hardware must secure in place the wireless modem device to a mounting plate and mounting screws must not touch the cabinet walls. Measure the radio signal strength in dBm, verify that the radio signal exceeds the signal strength specifications, and add measurements to signal strength measurements report.

Water deflection assemblies must not be damaged and must be re-installed if removed during the installation of the wireless modem antenna.

After the signal strength measurements report shows that the radio signal exceeds the signal strength specifications, install the wireless modem antenna. The installation of the wireless modem antenna must include sealing gasket and bolt mount using a locknut and a torque wrench, and must be weatherproof and watertight. The center of the wireless modem antenna must be placed at the same distance from the sides of the controller cabinet and a maximum of 5 inches from the back of the controller cabinet. Seal the controller cabinet after you install the wireless modem antenna and use specified sealant inside the controller cabinet on the hole used to install the wireless modem antenna. Measure the radio signal strength in dBm after installation of the wireless modem antenna, add measurements to signal strength measurements report.

#### **86-3.06D Payment**

Not used.

### **Add to section 86-3:**

#### **86-3.07 GLOBAL POSITIONING SYSTEM TIME BASE SYSTEM**

##### **86-3.07A General**

##### **86-3.07A(1) Summary**

Section 86-3.07 includes specifications for materials and construction of Global Positioning System (GPS) time base system in the controller cabinet.

##### **86-3.07A(2) Definitions**

**CTNET:** Traffic signal management and surveillance system for Model 170E controllers using AB3418/AB3418E protocol.

**signal system master controller:** Field master controller unit used to interface transportation management center and traffic signal controllers.

**traffic signal controller:** Local controller unit used to control traffic signal intersection or pedestrian crosswalk.

**TSMSS:** Traffic signal management and surveillance system for Model 2070 controllers using AB3418/AB3418E or NTCIP protocols.

**CTNET/TSMSS Lab:** It is located at Mail Stop 15, CTNET/TSMSS Branch, California Department of Transportation, Office of Traffic Design, 100 South Main Street, Room 04-031 (Signal Lab), Los Angeles, CA 90012. Contact Engineer for telephone number.

**86-3.07A(3) Submittals**

Within 10 days of completion of field testing, submit documentation of test results for the tests conducted for review and acceptance. Submittal must include location type, route name, county, route number, and post mile for each signal system master controller location tested.

**86-3.07A(4) Quality Control and Assurance**

Prototype equipment is not acceptable. Equipment must be off the shelf, must be of current standard production units manufactured by original equipment manufacturer, and must have been in production for a minimum of 6 months. Rebuilt, modified, or reconditioned equipment is not allowed.

Equipment must work with the existing Department traffic signal software without modification in existing software.

**86-3.07A(4)(a) Field Testing**

Field test GPS time source device and verify that it updates the year, month, day in month, day of week, hour, minutes and seconds on the signal system master controller every 60 seconds.

**86-3.07A(4)(b) Final Acceptance**

Final acceptance will occur after compliance with the following:

1. Field test results have been accepted.
2. Manuals and schematic drawings have been accepted.
3. Connections that were changed to perform tests have been restored and tested.

**86-3.07A(5) Warranty**

Furnish a 2-year replacement warranty from the manufacturer of the GPS time base system against any defects or failures. The effective date of the warranty is the date of acceptance of the installation. Furnish replacement parts within 10 days after receipt of the failed parts. The Department does not pay for the replacement. Deliver replacement parts to the following department maintenance electrical shop:

Bandini Maintenance  
7300 East Bandini Blvd  
Commerce, CA 90040

**86-3.07B Materials**

Equipment must comply with the TEES and the following:

1. GPS time source device must be designed for use with Model 170E controllers and must interface to a signal system master using Model 170E controller with TRFM software to establish two-way serial communications. GPS time source device must support serial communications with the existing traffic signal controller hardware and software without modification.
2. GPS time source device must comply with the GPS receiver, default configurations, QS command set, data output, protocols, LED indicators, GPS tracking, and environmental requirements specified in TEES, errata 1, chapter 10-section 9 "MODEL 2070-7G UNIVERSAL TIME BASE MODULE."
3. GPS time source device must be stand alone. The device must use a GPS receiver to get time from GPS satellites and provide accurate time to traffic controllers. The device must have a maximum drift of 0.3 seconds per day when the GPS signal is lost, and must have a rechargeable super capacitor for backup power of the real time clock and memory for up to 24 hours during power outages. The device must support command and response messages for user queries and for configurable settings via serial communications interface. The GPS time source device must comply with the following:

Serial Interface GPS Time Source Requirements	Serial Interface: TIA-232, from 300 to 19,200 bps Serial Interface Time Source: Data Accuracy ±10 milliseconds adjusted to compensate for data transmission according to data rate setting.
Power	DE-9 pin 9 for power input from Model 170E Traffic Controller C2 socket connector. DE-9 pin 9 Input Voltage: +5 V(dc) regulated,

Requirements	DE-9 pin 9 Input Current: 200 mA at +5 V(dc) Optional input Voltage: 24 V(dc) unregulated
GPS Requirements	Satellite Tracking: Minimum 1 satellite tracking for time and 4 satellites tracking for location. Track up to 8 satellites simultaneously
Mechanical Requirements	Serial Port: DCE DE-9 plug connector. GPS Connector: SMA receptacle or 50 Ohm BNC socket connector with SMA receptacle to BNC plug straight adapter. Dimensions: Maximum combined length, width, and height: 12 inches, Two mounting flanges with 2 keyhole screw mounts Optional power connector with AC adaptor.

4. Power and serial data cable must be an industrial grade cable with a DE-9 socket connector and a C2 plug, be used to connect the GPS time source device's DE-9 port to the signal system master controller's port C40S, be used for two-way serial communications between GPS time source device and signal system master controller, be used to provide power to the GPS time source device from the signal system master controller's port C40S.
5. Cable and wire management components include cable ties, wire and cable mounting devices, nonmetallic strain reliefs, fixed diameter clamps, and wire management brackets.

**86-3.07C Construction**

After successful quality assurance testing results and acceptance of the installation and test plans, install the GPS time base system.

At least 3 business days before installing the wireless data service system, notify the Engineer.

Equipment installation must not affect the normal activity of the controller cabinet's doors. Use wire management brackets every 1 foot in the cabinets to route cable. Use cables and wire management system components in the controller cabinet and equipment rack to avoid physical interference between cables and adjacent equipment, to allow equipment to be removed from controller cabinet without physical interference, and to keep terminal blocks clearly visible.

Comply with the manufacturer's installation instructions and recommendations to avoid equipment damage during installation. GPS time source device must be mounted, connected to port C40S of Model 170E controller used as signal system master, and connected to wireless modem antenna specified in section 86-3.06.

The device must be connected to the wireless modem antenna's SMA plug straight connector. The SMA receptacle to BNC plug straight adapter included with the wireless modem antenna must be used if the GPS time source device has a BNC receptacle connector. A stand alone GPS time source device's status LEDs must face upward, and must be mounted on the controller cabinet's rack at the same side as terminal block TB0 and close to the top of the rack and to the back of the cabinet.

**86-3.07D Payment**

Not Used

**Replace section 86-4.01D(1)(c)(ii) with:**

**86-4.01D(1)(c)(ii) Warranty**

Provide a manufacturer's written warranty against defects in materials and workmanship for LED signal modules for a minimum period of 48 months after installation of LED signal modules. Replacement LED signal modules must be provided within 15 days after receipt of failed LED modules at your expense. The Department pays for shipping the failed modules to you. All warranty documentation must be submitted to the Engineer before installation. Replacement LED signal modules must be delivered to State Maintenance Electrical Shop at 7316 E. Bandini Blvd., Commerce, Ca 90040.

**Add to section 86-4.01D(2)(a):**

LED signal module must be manufactured for 12-inch circular.

**Replace section 86-4.03H with:**

**86-4.03H LED Countdown Pedestrian Signal Face Modules**

**86-4.03H(1) General**

**86-4.03H(1)(a) Summary**

Section 86-4.03H includes specifications for installing a LED countdown PSF module into a standard Type A pedestrian signal housing. Comply with TEES.

**86-4.03H(1)(b) Definitions**

Not Used

**86-4.03H(1)(c) Submittals**

Before shipping LED countdown PSF modules to the job site, submit all modules and the following items to METS:

1. Delivery form with Contract number and contact information
2. Installation manual and schematic wiring diagram
3. Product information, including manufacturer's name and month and year of manufacture
4. List of model, lot, and serial numbers

Submit documentation of the manufacturer's production QA, including test data showing the modules comply with the following requirements:

1. Luminous intensity as shown in the table titled "Luminance Values."
2. Power factor after burn-in.
3. Test current flow measurements in amperes after burn-in. The measured values must comply with the design qualification figures. Record the measured ampere values with rated voltage on the product labels.

Submit the manufacturer's warranty before installing LED countdown PSF modules.

**86-4.03H(1)(d) Quality Control and Assurance**

**86-4.03H(1)(d)(i) General**

The Engineer rejects a module if a visual inspection reveals any of the following defects:

1. Exterior physical damage
2. Assembly anomalies
3. Scratches
4. Abrasions
5. Cracks
6. Chips
7. Discoloration
8. Other surface defects

The Department tests LED countdown PSF modules under ANSI/ASQ Z1.4 and California Test 606. The module submitted for testing must be representative of typical production units.

Comply with testing requirements for electrical material and equipment under section 86-2.14.

### **86-4.03H(1)(d)(ii) Warranty**

Provide a 5-year manufacturer's replacement warranty against defects or failures. The warranty period starts on the date of Contract acceptance. Furnish replacement parts within 15 days after notification of a failed module. The Department does not pay for replacement modules. Deliver replacement modules to the Department's Maintenance Electrical Shop at:

7316 E Bandini Blvd.,  
Commerce,  
CA 90040

### **86-4.03H(2) Materials**

A LED countdown PSF module must:

1. Use LED as the light source.
2. Be made of material complying with ASTM D 3935.
3. Be designed to mount behind or to replace face plates of a standard Type A housing as specified in the ITE publication *Equipment and Material Standards*, chapter 3, "Pedestrian Traffic Control Signal Indications," and the *California MUTCD*.
4. Have a minimum power consumption of 10 W for the "Upraised Hand."
5. Have internal components supported such that they withstand mechanical shock and vibration from high winds and other sources.
6. Use the required color and be the ultra-bright type rated for 100,000 hours of continuous operation for a temperature range from -40 to +74 degrees C.
7. Have replaceable signal lamp optical units.
8. Fit into the housing of a pedestrian signal section without modification.
9. Be a single, self-contained device that does not require on-site assembly for installation.
10. Have the following information permanently marked on the back of the module:
  - 10.1. Manufacturer's name
  - 10.2. Trademark
  - 10.3. Model number
  - 10.4. Serial number
  - 10.5. Lot number
  - 10.6. Month and year of manufacture
  - 10.7. Required operating characteristics, including:
    - 10.7.1. Rated voltage
    - 10.7.2. Power consumption
    - 10.7.3. Volt-ampere
    - 10.7.4. Power factor
11. Have prominent and permanent vertical markings for accurate indexing and orientation within the signal housing if a specific mounting orientation is required. Markings must be a minimum of 1 inch in height and include an up arrow and the word "up" or "top."

The circuit board and the power supply must be contained inside of the LED countdown PSF module. The circuit board must comply with TEES, chapter 1, section 6.

The enclosure containing the power supply or the electronic components of the module, except the lens, must be made of UL 94 V-0 flame-retardant material.

Each symbol must be at least 9 inches high and 5-1/4 inches wide. The lens' signal output for the "Walking Person" and "Upraised Hand" symbols and the countdown display must not exceed a ratio of 5 to 1 for the highest and lowest luminance values. The symbols must comply with ITE publication *Equipment and Material Standards*, chapter 3, "Pedestrian Traffic Control Signal Indications," and the *California MUTCD*. The 2-digit countdown timer, "Upraised Hand," and "Walking Person" indications must be electronically isolated from each other. The 3 indications must not share a power supply or interconnect circuitry.

The module must maintain an average luminance value for at least 5 years of continuous signal operation for a temperature range from -40 to +74 degrees C.

The module must operate over the specified ambient temperature and voltage range and be readable both day and night at distances up to the full width of the area to be crossed. Upon initial testing at 25 degrees C, the module must have at least the luminance values shown in the following table:

**Luminance Values**

PSF module symbol	Luminance
"Upraised Hand" and 2-digit countdown timer	1,094 fL
"Walking Person"	1,547 fL

The color output of the module must comply with chromaticity requirements in section 5.3 of ITE publication *Equipment and Material Standards* chapter 3, "Pedestrian Traffic Control Signal Indications."

When operating over a temperature range from -40 to +74 degrees C, the measured chromaticity coordinates of the module must comply with the following requirements for 5 years after Contract acceptance:

**Chromaticity Standards (CIE Chart)**

"Upraised Hand" and 2-digit countdown timer (portland orange)	$0.600 \leq X \leq 0.659$ Y: Not greater than 0.390 or less than 0.331 or less than $0.990 - X$
"Walking Person" (lunar white)	X: Not less than 0.280 or greater than 0.400 Y: Not less than $0.0483 + 0.7917 * X$ or greater than $0.0983 + 0.7917 * X$

The module must not exceed the power consumption requirements shown in the following table:

**Maximum Power Consumption Requirements**

PSF module display	At 24 °C	At 74 °C
"Upraised Hand"	10.0 W	12.0 W
"Walking Person"	9.0 W	12.0 W
2-digit countdown timer	6.0 W	8.0 W

The wiring and terminal block must comply with section 13.02 of ITE publication *Equipment and Material Standards*, chapter 2, "Vehicle Traffic Control Signal Heads." The PSF module must have spade lugs and 3 secured, jacketed copper wires that comply with NEC and are:

1. Color coded
2. 3 feet long
3. 600 V(ac)
4. 20 AWG minimum stranded
5. Rated for service at +105 degrees C

The module must operate:

1. At a frequency of  $60 \pm 3$  Hz over a voltage range from 95 to 135 V(ac) without flicker perceptible to the unaided eye. Fluctuations of the line voltage must have no visible effect on the luminous intensity of the indications. The rated voltage for measurements must be 120 V(ac).
2. With currently-used Department controller assemblies, including solid-state load switches, flashers, and conflict monitors. Comply with TEES, chapters 3 and 6. If an alternating current of 20 mA or less is applied to the unit, the voltage read across the 2 leads must not exceed 15 V(ac).
3. With a smart control and regulation mode that exhibits countdown displays automatically adjusted to the traffic controller's programmed intervals.

The countdown PSF module must operate during the pedestrian change interval. The module must begin counting down when the flashing "Upraised Hand" interval turns on, counting down to 0 and turning off when the steady "Upraised Hand" interval turns on.

The module's on-board circuitry must:

1. Include voltage surge protection to withstand high-repetition noise transients. The voltage surge protection must comply with NEMA Standard TS, section 2.1.6.
2. Comply with Class A emission limits for electronic noise under 47 CFR 15, subpart B.

The module must provide a power factor of 0.90 or greater.

The total harmonic distortion from a current and voltage induced in an alternating-current power line by a PSF module must not exceed 20 percent at an operating temperature of 25 degrees C.

The module's circuitry must prevent light emission perceptible to the unaided eye when a voltage of 50 V(ac) or less is applied to the unit.

When power is applied to the module, light emission must occur within 90 ms.

#### **86-4.03H(3) Construction**

Use LED countdown PSF modules from the same manufacturer.

Install the module in a standard Type A pedestrian signal housing. Special tools must not be required for installing the modules.

The installation of the module into the pedestrian signal face must require only the removal of the lens, reflector, and existing LED module.

#### **86-4.03H(4) Payment**

Not Used

#### **Add to section 86-4.03I(1)(b):**

Submit warranty documentation as an informational submittal before installing LED PSF modules.

#### **Replace section 86-4.03I(1)(c)(ii) with:**

#### **86-4.03I(1)(c)(ii) Warranty**

Submit a 5-year manufacturer's warranty against defects in materials and workmanship for LED PSF modules. The 5-year warranty period starts on the date of Contract acceptance. Furnish replacement modules within 15 days after receiving the failed modules. The Department does not pay for replacement modules. Deliver replacement modules to the Department's Maintenance Electrical Shop at:

7316 E. Bandini Blvd.,  
Commerce,  
Ca 90040

#### **Add to the 6th paragraph in section 86-4.03I(2):**

Installation of the LED PSF module into the pedestrian signal face only requires the removal of lenses, reflectors, and existing LED modules.

#### **Replace section 86-4.03J with:**

#### **86-4.03J Ramp Metering Sign**

#### **86-4.03J(1) General**

#### **86-4.03J(1)(a) Summary**

Section 86-4.03J includes specifications for installing Ramp Meter LED sign in type A modified pedestrian signal.

### **86-4.03J(1)(b) Submittals**

Before shipping Ramp Meter LED sign to job site, submit to METS:

1. Delivery form including district number, EA, and contact information.
2. List containing all LED signal module serial numbers anticipated for use.
3. Ramp Meter LED sign with LED signal modules.

Submit warranty documentation before installation.

### **86-4.03J(1)(c) Quality Control and Assurance**

#### **86-4.03J(1)(c)(i) General**

Ramp Meter LED sign must be one listed on the Pre-Qualified Products List for LED traffic signals at:

[http://www.dot.ca.gov/hq/esc/approved\\_products\\_list](http://www.dot.ca.gov/hq/esc/approved_products_list)

The Department will test Ramp Meter LED sign shipments per Normal Sampling Plan ANSI/ASQC Z1.4, Tables for Inspection by Attributes. The Department completes testing within 30 days after delivery to METS. Ramp Meter LED sign tested or submitted for testing must be representative of typical production units. Ramp Meter LED sign will be tested under California Test 604. All parameters of the specification may be tested on the modules. LEDs must be spread evenly across the module. Measurements will be performed at the rated operating voltage of 120 V (ac).

After testing, pick up accepted Ramp Meter LED sign from METS and deliver to the job site.

#### **86-4.03J(1)(c)(ii) Warranty**

Furnish a 4-year replacement warranty from the manufacturer of the Ramp Meter LED sign against any defects or failures. The effective date of the warranty is the date of installation. Furnish replacement components within 15 days after receipt of the failed parts. The Department does not pay for the replacement. Deliver replacement Ramp Meter LED sign to the following department maintenance electrical shop:

Bandini Maintenance Yard  
7316 E. Bandini Blvd.  
Commerce, CA 90040

### **86-4.03J(2) Materials**

The "Meter On" sign must be a white message sign complying with section 86-4.03.

Ramp Meter LED sign must:

1. Be weather tight and connect directly to electrical wiring.
2. Be capable of optical unit replacement.
3. LED module uses AlInGaP technology
4. LED module be ultra bright type rated for 100,000 hours of continuous operation from -40 to +165 degrees F
5. Each LED module must provide an average luminous intensity of 1,547 foot-lambert or more throughout the useful life over the operating temperature range.
6. The LED uniformity ratio of an illuminated symbol must not exceed 4 to 1 between the highest luminance area and the lowest luminance area in the module.
7. The color output of the LED module must comply with the requirements of Section 5.3 in the ITE Publication: Equipment and Material Standards, Chapter 3 (Pedestrian Traffic Control Signal Indications).
8. The measured chromatical coordinates of LED module must operate over a temperature range of -40 to +165 degrees F and comply with section 86-4.03I(2).
9. Be a single, self-contained device, not requiring on-site assembly for installation into standard Type A housing.

10. Ramp Meter LED sign Identification must include the following operating characteristics permanently marked on the back of the module: rated voltage and rated power in Watts and Volt-Ampere.
11. Maximum power consumption requirements for the LED modules in Watts are:
  - 11.1 15.0 at 77 degrees F.
  - 11.2 17.0 at 165 degrees F.

Ramp Meter LED sign must have an operational lifecycle rating of 48 months. During the operational lifecycle, LED signal modules must meet all parameters of this specification.

Individual LEDs must be wired such that a catastrophic loss or failure of one LED will result in loss of not more than 5 percent of the module light output. Failure of an individual LED in a string must not result in the loss of entire string or other indication.

Wiring and terminal block must comply with Section 13.02 of ITE publication, Equipment and Material Standards, Chapter 2, "Vehicle Traffic Control Signal Heads." The LED module must be supplied with spade lugs and 3 secured, color-coded, 3-foot long, 600 V, 20 AWG minimum stranded jacketed copper wires. Wires must comply with NEC, rated for service at +221 degrees F.

Ramp Meter LED sign must operate:

1. At a frequency of  $60 \pm 3$  Hz, over a voltage range from 95 to 135 V(ac), without perceptible flicker to the unaided eye. Fluctuations of line voltage must have no visible effect on luminous intensity of the indications. Rated voltage for measurements must be 120 V(ac).
2. Compatible with currently used State controller assemblies, including solid state load switches, flashers, and conflict monitors. Comply with TEES Chapters 3 and 6. If a 20 mA alternating current or less is applied to the unit, the voltage read across the 2 leads must be 15 V(ac) or less.

Ramp Meter LED sign on-board circuitry must:

1. Include voltage surge protection to withstand high-repetition noise transients. The voltage surge protection must comply with NEMA Standard TS2, Section 2.1.6.
2. Comply with FCC, Title 47, SubPart B, Section 15 regulations for Class A emission limits for electronic noise.

Ramp Meter LED sign must provide a power factor of 0.90 or greater.

Total harmonic distortion from current and voltage induced into an alternating current power line by LED signal module must not exceed 20 percent at an operating temperature of 77 degrees F.

When power is applied to LED signal module, light emission must occur within 90 ms.

Power supply must be integral to the module.

Internal components must be adequately supported to withstand mechanical shock and vibration from high winds and other sources.

Lens and LED signal module material must comply with the ASTM specifications for that material.

Enclosures containing either the power supply or electronic components of LED signal module, except lenses, must be made of UL94VO flame-retardant material.

LED signal module must have prominent and permanent vertical markings for accurate indexing and orientation within the signal housing. Markings must include an up arrow, or the word "UP" or "TOP."

Lenses must have 3/16 inch, minimum thickness, clear acrylic or polycarbonate plastic or 1/8 inch nominal thickness glass fiber reinforced plastic with molded one piece neoprene gasket. Message lettering for "METER" must be "Series C," 4-1/2 inches high with uniform 1/2 inch stroke, and for "ON" must be "Series C," 6 inches high, with uniform 1/2 inch stroke. Letters must be clear, transparent or translucent, with black opaque background silk screened on to the second surface of the lens.

### **86-4.03J(3) Construction**

No special tools for installation are allowed.

#### **86-4.03J(4) Payment**

Not used.

#### **Add to section 86-5.01A(1):**

Loop wire must be Type 2.

Loop detector lead-in cable must be Type B.

Slots must be filled with asphaltic emulsion sealant.

For Type E detector loops, sides of the slot must be vertical and the minimum radius of the slot entering and leaving the circular part of the loop must be 1-1/2 inches. Slot width must be a maximum of 5/8 inch. Loop wire for circular loops must be Type 2. Slots of circular loops must be filled with hot-melt rubberized asphalt sealant.

The depth of the loop sealant above the top of the uppermost loop wire in the sawed slots must be 2 inches, minimum.

#### **Replace "Reserved" in section 86-5.01C with:**

This work consists of furnishing and installing a microwave vehicle detection system (MVDS).

#### **86-5.01C(1) Materials List and Drawings**

A list of materials that you proposes to install for the MVDS, together with the drawings and other data, must be submitted under section 86-1.04. Additionally, the following must be provided before the completion of the Contract:

1. Certificate of Compliance - Submit a certificate of compliance for MVDS.
2. Site Analysis Report - Prior to MVDS installation, you must review each detection site and provide a written analysis recommending the optimum sensor placement for complying with the performance requirements of this special provision. The analysis must be reviewed and approved by the MVDS manufacturer.
3. Lane Configuration - The documentation must include a diagram that illustrates how the microwave beam is covering the traffic lanes as well as the MVDS connector pins or wire terminals that correspond to the respective lanes. The lanes must be identified by direction (i.e., NB, SB, EB, WB) and in order with lane one being the lane nearest to the center of the roadway.
4. Mounting and Wiring Information - You must provide to the Engineer for authorization 1 set of detailed diagrams showing wiring and service connections for each MVDS. The authorized diagrams must be covered separately on each side with clear self-adhesive plastic and placed in a heavy-duty plastic envelope. The envelope must be attached securely to the inside of the cabinet door or at a location ordered.
5. Communication Protocol - The MVDS communication protocol must be open and must be freely available for use in the public domain. You must provide documentation that defines the complete MVDS communication protocol. The documentation consists of a message structure organization, data packet length, and all information necessary to make use of the messages.
6. Remote Programming - You must provide all information and software necessary for operating the system from a remote Windows 2000/NT-based or newer PC. This information and software must include at a minimum the capability to calibrate, tune, align, and program the MVDS and be provided on a CD compatible with Windows 2000/NT-based or newer PC. The information must be formatted such that the files can be matched with the equipment being calibrated or aligned. This documentation must contain files that allow for replacement equipment to be loaded with the same configuration.
7. MVDS Accuracy Analysis - You must be responsible for conducting MVDS Performance Testing and must submit an MVDS accuracy analysis that complies with the requirements of the special provisions within 15 days of MVDS testing. The original video recordings as well as DVD or CD copies of the video images covering the analysis periods must be included.
8. Acceptance Testing Documentation - You must provide a test plan including the time and the period of the testing to be authorized. The test plan must be organized to allow the Engineer to perform

acceptance testing by using the documentation and without assistance from you. You must collect and submit the data to be certified. If requested, the data must be collected in the presence of the Engineer.

9. Acceptance Testing Schedule - You must submit a testing schedule for authorization 15 days prior to acceptance testing of the MVDS. If the testing period extends beyond the normal working shift or if you fails to provide the necessary material for the testing within 1 hour of the scheduled testing start time, the Engineer may cancel the testing for the day.
10. Training - You must provide a copy of the training material for authorization 30 days prior to the training. The content of the training must include instruction on how to align, program, adjust, calibrate, and maintain the MVDS.

### **86-5.01C(2) Functional Requirements**

MVDSs must simultaneously provide vehicle detection data in the form of vehicle presence, volumes, counts, speed, classification, and occupancy for a minimum of 8 lanes of traffic and must comply with the performance requirements of the special provisions. MVDSs must provide a separate zone per lane and detect vehicles as close as 9.8 feet and as far as 197 feet from the MVDS sensor. MVDSs must monitor traffic lanes in the presence of barrier railings, guard railings, and other obstacles.

MVDSs must comply with the following detection performance criteria when installed at a minimum of 9.8 feet from the nearest lane and at a minimum height of 16.4 feet above the roadway detection zone:

1. Average 5-minute volumes for all lanes combined with better than 95-percent accuracy compared to vehicles observed in video images for the same period for any 15-minute period selected by the Engineer.
2. Average 30-second volumes in every lane with better than 90-percent accuracy compared to vehicles observed in video images for the same period for any 5-minute period selected by the Engineer.
3. Average 30-second speed in any lane with better than 95-percent accuracy for any 5-minute period selected by the Engineer.
4. Average 5-minute occupancy for any lane with better than 85-percent accuracy for any 15-minute period selected by the Engineer.
5. Count accuracy, when compared to vehicles observed in video images for the same period, must be not less than 90 percent for any lane and not less than 95 percent for all lanes combined.
6. Average 15-minute classification according to user-defined criteria with better than 90-percent accuracy compared to vehicles observed in video images for the same period. Vehicle or length classification must be provided for categories of small car, average car, mid size car, long car, and extra-long car that are user definable by either length parameters, minimum length to maximum length for the category, or by a multiple of length of the average car.
7. You must provide the criteria for speed and volume acceptance testing for authorization. You must also provide speed and volume data for verification by the Engineer.

MVDS must consist of a sensor unit and include all required mounting hardware, power supplies, surge suppression, cables, connectors, and wiring. The MVDS sensor must include, as a minimum, a directional microwave transmitter, antenna, microwave receiver, processor, memory, and communication interface.

The MVDS must have an TIA-232, TIA-485, or Ethernet communication port that supports the National Transportation Communication for ITS Protocol (NTCIP). The MVDS communication protocol must be nonproprietary and openly specified and available for use in the public domain. The MVDS must be addressable and must download count, speed, and occupancy data when polled by the traffic management center computer. Speed must be configurable in U.S. customary or metric units. The MVDS must support unit setup from a serial console port on the MVDS unit. The console port protocol must support sensor unit setup from a local Windows 7 or newer compatible laptop or from a remote location with a desktop computer and standard phone modem.

When MVDS sensor contact outputs will be connected to Model 170E/2070 controller to emulate inductive loops, comply with the following:

1. The MVDS sensors must be connected to a microwave sensor interface card (MSIF) installed in the input file of a Department-furnished Model 170E or Model 2070 controller cabinet.

2. Each detection zone must provide an optically isolated relay contact pair that follows the presence of vehicles in every traffic lane and sends signals to the controller with the accuracy stated in the special provisions.
3. The MSIF must have indications for power, communication, and the real-time operation of each detection contact output.

You must install an MVDS termination assembly (MTA) as shown. The MTA must be a single circuit board or a set of modular DIN-rail rack-mounted assemblies. The MTA must provide screw cable-lug terminations for all MVDS units with clearance for routing the cables and labels to identify the connected MVDS detectors. The MVDS unit must be connected in the order shown or as ordered. Each lane detection zone must have an LED that indicates vehicle presence with a minimum viewing angle of 50 degrees and visible from 5 feet in daylight. Power must be routed from the MTA to each MVDS unit. Each MVDS power connection must have fast-blow AGC type fuse or a resettable circuit breaker such that the loss of power to any single MVDS due to overcurrent does not limit the operation of the other connected MVDS. The fuses or breakers must be easily accessible and replaceable or resettable without requiring tools or removing cables, connectors, or other terminations. The MTA must have DE9 male connectors for every connected MVDS unit for TIA-232 or TIA-485 communications and a local laptop computer for performing setup and diagnostics as well as remote communications. The connectors must be labeled and provide internal routing of data between the DB9 connectors and the MVDS terminal strips. You must supply the cable and connectors for connecting the communication modem.

MVDSs must be user programmable in the field via the MVDS unit console port with a Windows 7 or newer compatible laptop computer. You must provide software, firmware, and equipment to set up, calibrate, and operate the unit. MVDS software must observe the vehicular traffic and automatically place detection lanes and set the sensor sensitivity. MVDSs must be designed such that a trained Department employee can configure and calibrate the MVDS in less than 15 minutes per lane once the MVDS sensor unit is installed.

#### **86-5.01C(3) Technical Requirements**

MVDSs must be FCC certified under 47 CFR 15 for low power, unlicensed, continuous radio transmitter operation. The MVDS must comply with FCC regulations for all specified operating conditions and over the expected life of the MVDS.

MVDS sensor unit must not weigh more than 11 pounds. The MVDS must operate over a temperature range from -30 degrees C to +70 degrees C, with up to 95 percent relative humidity. The MVDS sensor enclosure must be weatherproof with a NEMA 3R rating and the sensor mounted and directed perpendicular to the flow of traffic lanes at the locations shown.

All electronic assemblies must comply with the specifications in chapters 1 and 5 of the TEES.

The MSIF must be inserted into the controller input file slots using the edge connector to obtain limited 24 V(dc) power and to provide contact closure outputs. No rewiring to the Model 170E or Model 2070 cabinet must be allowed. The MSIF must comply with the specifications in chapter 1 as well as sections 5.2.8, 5.2.8.1, 5.2.8.2, 5.4.1, 5.4.5, and 5.4.6, 5.5.1, 5.5.5, and 5.5.6 of TEES.

MVDS sensors must be wired with a connectorized cable harness. Cables must run continuously without splices between the sensor and controller cabinet and terminate in labeled terminal blocks identified with the purpose served. The connector must be a standard mil type and rated plug. The cable must have the number of conductors specified by the MVDS manufacturer to support the number of detection zones shown plus spares for 2 future zones with an overall shield and copper drain wire. Conductors must be stranded copper equal to or exceeding the minimum strands and wire dimensions specified by the MVDS manufacturer for the wiring distance involved and covered with a minimum 12 mils polyvinyl chloride (PVC) insulation rated for 300 V at 105 degrees C. The outer jacket must be chrome PVC with minimum thickness of 53 mils and the outside diameter of the cable must not exceed 3/4 inch. A minimum of 6.5-foot slack of MVDS cable must be coiled at the bottom of the controller cabinet. Slack in other cabinets must be as shown or as ordered.

MVDS sensor unit power supplies or transformers must be vertically mounted on a standard DIN-rail rack using standard mounting hardware. You must wire the MVDS power conductors to DIN-rail rack-mounted terminal blocks in the controller cabinet as ordered. The serial data communication output conductors must be terminated at TB-0 and continue for a minimum of 9.8 feet to a DB9F connector for setup and

diagnostic access. The contact pair output conductors must be terminated at terminal block, TB-2. The ends of unused and spare conductors must be coiled and taped to prevent accidental contact to other circuits. Conductors inside the cabinet must be labeled for the functions as shown on the authorized detailed diagrams.

The power supply or transformer must comply with or exceed the following minimum requirements:

	Power supply	Transformer
Power cord	Standard 120 V(ac), 3 prong cord, at least 40 inches in length (may be added by Contractor)	Standard 120 V(ac), 3 prong cord, at least 40 inches in length (may be added by Contractor)
Type	Switching mode type	Class 2
Rated power	Twice (2x) full system load	Twice (2x) full system load
Operating temperature	From -35 to +74 °C	From -35 to +74 °C
Operating humidity range	From 5 to 95%	From 5 to 95%
Input voltage	From 90 to 135 V(ac)	From 90 to 135 V(ac)
Input frequency	60 +/- 1 Hz	60 +/- 1 Hz
Inrush current	Cold start, 25 A max. at 115 V	N/A
Output voltage	As required by the MVDS	As required by the MVDS
Overload protection	From 105 to 150 percent in output pulsing mode	Power limited at >150 percent
Over voltage protection	From 115 to 135 percent of rated output voltage	N/A
Setup, rise, hold up	800 ms, 50 ms, 15 ms at 115 V(ac)	N/A
Withstand voltage	I/P-0/P:3 kV, I/P-FG:1.5 kV, for 60 sec.	I/P-0/P:3 kV, I/P-FG:1.5 kV, for 60 sec
Working temperature	Not to exceed 70 °C@30% load	Not to exceed 70 °C@30% load
Safety standards	UL 1012, 60950	UL 1585
EMC standards		N/A

Field terminated circuits must include transient protection that complies with IEEE Standard 587-1980 Category C.

The MVDS must automatically restore normal operation following a power failure within 3 minutes and not require manual intervention. The MVDS must maintain the configuration and calibration information in nonvolatile memory and retain the information while powered off for at least 90 days.

The MVDS must be configurable for 30-second to 24-hour polling cycles and store vehicle count, speed, classification, and occupancy data in 10-second to not less than 15-minute intervals.

The MVDS must be tested and in standard production for a minimum of 3 months. You must not install any MVDS older than 6 months from the scheduled start date of the MVDS installation as indicated by date codes or serial numbers of electronic circuit assemblies.

The MVDS system and all supporting equipment must be designed to operate continuously in an outdoor traffic monitoring and control environment. You must provide a manufacturer's warranty stating that the manufacturing quality and electronic components must support a "mean time between failures of 10 years in this environment.

#### **86-5.01C(4) Construction**

You must assure that the MVDS will not cause harmful interference to radio communication in the area of the installation as required by 47 CFR 15. The MVDS units must be installed such that each unit operates independently and does not interfere with other MVDS units or other equipment in the vicinity.

You are responsible for site visits and analysis of each proposed pole location to assure that the detector placement will comply with the manufacturer's published installation instructions and the performance required in the special provisions. You must confirm detector placement with the manufacturer before performing work at the MVDS location. Whenever the manufacturer's analysis requires a change in the proposed pole location, you must arrange a meeting with the manufacturer and the Engineer to select a new pole location.

You must not proceed with any MVDS installation until the pole location is authorized.

You are responsible for the compatibility of components and for making necessary calibration adjustments to deliver the performance required in the special provisions. You must provide equipment required to set up, calibrate, verify performance, and maintain the MVDS.

You must provide programming software needed to support the MVDS. The software must be installed in the appropriate equipment and used for the acceptance testing.

#### **86-5.01C(5) Testing**

Accuracy of the MVDS system must be verified by comparing the MVDS vehicle counts to recorded video image counts for the same period. The video camera must be located and oriented so that traffic is visible in all lanes. Video images must be time stamped and analysis periods recorded to a DVD or CD media for viewing on a PC. The video field of view must totally encompass the area in which vehicles are detected. You must provide a means for synchronizing the test starting and ending times or provide software that displays time stamped MVDS data along with the video images of the moving vehicles. You must provide the Engineer with the original recording medium and documentation that supports the accuracy analysis and make a copy of these materials for its own use.

The accuracy test must take place during a complex traffic period as specified by the Engineer. 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:

1. The minimum recording period must be 30 minutes when the recording includes congested traffic (vehicles traveling at less than 20 mph for five or more minutes in any lane).
2. The minimum recording period must be 45 minutes when the traffic flow exceeds 1500 vehicles per hour in any lane during the test period.
3. The minimum recording period must be 60 minutes when the flow is less than 1500 vehicles per hour in every lane.

The analysis must be based on a minimum of 100 detected vehicles in every lane and cover the same time period for all lanes. The time period 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 MVDS and manual counts are included in the performance criterion specified in the special provisions.

MVDS unit count must be compared to the vehicle counts under these traffic conditions. Vehicles licensed for use on State roads must be counted by the MVDS. The data accuracy must be determined by the formula  $100\{1-[(TC-MC)/TC]\}$ , where TC=traffic count derived from the media recording, MC=MVDS-reported count over the same period of time, and the resulting fraction is expressed as an absolute value.

The accuracy of each MVDS unit must be determined and documented so each unit may be authorized or rejected separately by the Engineer. Failure to submit the materials at the conclusion of testing invalidates the test. The recorded media serves as acceptance evidence and must not be used for calibration. The calibration must have been completed prior to testing and verification.

The Engineer will review the accuracy data findings and accept or reject the results within 15 days. Determination of vehicle anomalies or unusual occurrences will be decided by the Engineer. Data or counts that are not accepted by the Engineer must be considered errors and count against the MVDS unit's calibration. If the Engineer finds that the MVDS does not comply with the performance requirements, you must recalibrate and retest the unit and resubmit new test data within 10 days. Following 3 failed attempts, you must replace the MVDS detector with a new unit.

In addition to the accuracy analysis performed, you must provide equipment, software, documentation, support equipment, and any other materials, personnel, and devices that may be required for acceptance testing by the Engineer. You must notify the Engineer 15 days before the MVDS unit is ready for acceptance testing. Testing must be scheduled to be accomplished before the end of the normal work shift.

**86-5.01C(6) Training**

You must provide a minimum of 5 hours of training by a certified manufacturer's representative for up to 6 Department personnel selected by the Engineer. The content of the training must include instruction on how to align, program, adjust, calibrate, and maintain the MVDS. You must provide materials and equipment for the training. You must provide the Engineer 15 days notice prior to the training

**86-5.01C(7) Payment**

Not Used

**Add to section 86-5.01:****86-5.01E Long Lead-in Cable Loop Detector Sensor Unit****86-5.01E(1) General**

Section 86-5.01E includes installing long lead-in cable loop detector (LLLD) sensor unit inside traffic controller cabinet.

**86-5.01E(2) Materials**

Comply with Chapter 5 of the TEES.

Submit a Certificate of Compliance from the manufacturer for each LLLD sensor unit.

Submit all warranty documentation before installation.

Furnish a 2-year replacement warranty from the manufacturer of the LLLD sensor unit against any defects or failures. The effective date of the warranty is the date of successful completion of the acceptance testing. The Department does not pay for the replacement.

LLLD sensor units must have 2 channels capable of detecting vehicles on a single Type E loop with a 3000 feet lead-in-cable.

Each LLLD sensor unit channel must have a sensitivity based on delta L threshold not delta L only.

There must be 8 threshold levels corresponding to 8 nH, 16 nH, 32 nH, 64 nH, 128 nH, 256 nH, 512 nH and 1024 nH.

The following exceptions to the TEES for LLLD sensor unit channel are allowed:

1. Three frequency settings minimum.
2. The operating frequency of 40 kHz is not required as long as the sensor unit complies with all other FCC rules.
3. The minimum Q requirement of 5 is not required if all other functional requirements are met.
4. Pulse mode requirements may vary from TEES if approved.

**86-5.01E(3) Construction**

Not Used

**86-5.01E(4) Payment**

Not Used

**Add to section 86-5.01:****86-5.01F VIDEO IMAGE VEHICLE DETECTION SYSTEM****86-5.01F(1) General****86-5.01F(1)(a) Summary**

Section 86-5.01F includes installing video image vehicle detection system (VIVDS) for traffic signals.

#### **86-5.01F(1)(b) Definitions**

**Video Detection Unit (VDU):** Processor unit that converts the video image from the camera and provides vehicle detection in defined zones. Unit includes an image processor, extension module, and communication card.

**Video Image Sensor Assembly (VIS):** An enclosed and environmentally-protected camera assembly used to collect the video image.

**Video Image Vehicle Detection System (VIVDS):** A system that detects video images of vehicles in defined zones and provides video output.

#### **86-5.01F(1)(c) Submittals**

Submit documentation within 30 days after Contract approval but before installing VIVDS equipment.

The documentation submittal must include:

1. Certificate of Compliance: As specified in section 6-3.05E
2. Site Analysis Report: Written analysis for each detection site, recommending the optimum video sensor placement approved by the manufacturer
3. Lane Configuration: Shop drawing showing:
  - 3.1. Detection zone setback
  - 3.2. Detection zone size
  - 3.3. Camera elevation
  - 3.4. Selected lens viewing angle
  - 3.5. Illustration of detection zone mapping to reporting contact output
  - 3.6. Illustration of output connector pin or wire terminal for lane assignment
4. Configuration Record: Windows PC compatible CD containing:
  - 4.1. Proposed zone designs
  - 4.2. Calibration settings
5. Mounting and Wiring Information: Manufacturer approved wiring and service connection diagrams.
6. Communication Protocol: Industry standard available in public domain. Document defining:
  - 6.1. Message structure organization
  - 6.2. Data packet length
  - 6.3. Message usability
  - 6.4. Necessary information to operate a system from a remote windows based personal computer
7. Programming Software: CD containing set up and calibration software that observes and detects the vehicular traffic, including bicycles, motorcycles, and sub-compact cars, with overlay of detection zones and allows adjustment of the detection sensitivity for a traffic signal application.
8. Detector Performance DVD Recordings and Analysis: Performance analysis based on 24-hour DVD recording of contiguous activity for each approach. Include:
  - 8.1. Two contiguous hours of sunny condition, with visible shadows projected a minimum of 6 feet into the adjacent lanes
  - 8.2. Two 1-hour night periods with vehicle headlights present
9. Preventative Maintenance Parts Documentation: List of equipment replacement parts for preventative maintenance, including:
  - 9.1. Electrical parts
  - 9.2. Mechanical parts
  - 9.3. Assemblies

Allow 7 days for the Engineer to review the documentation submittal.

If the Engineer requires revisions, submit a revised submittal within 5 days of receipt of the Engineer's comments and allow 5 days for the Engineer to review. If agreed to by the Engineer, revisions may be included as attachments in the resubmittal. The Engineer may conditionally approve, in writing, resubmittals that include revisions submitted as attachments, in order to allow construction activities to proceed.

Upon the Engineer's approval of the resubmittal, submit copies of the final documents with approved revisions incorporated.

Submit an acceptance testing schedule for approval 15 days before starting acceptance testing.

When beginning acceptance testing of VIVDS and detector performance and analysis, submit approved copies of the following:

1. Configuration Record: Windows PC compatible CD containing:
  - 1.1. Final zone designs
  - 1.2. Calibration settings to allow reinstallation
2. Mounting and Wiring Information: Final wiring and service connection diagrams.
  - 2.1. One copy for the Engineer
  - 2.2. A second copy wrapped in clear self-adhesive plastic, be placed in a heavy duty plastic envelope, and secured to the inside of the cabinet door.

#### **86-5.01F(1)(d) Quality Control and Assurance**

##### **86-5.01F(1)(d)(i) General**

VIVDS and support equipment required for acceptance testing must be new and as specified in the manufacturer's recommendations. Date of manufacture, as shown by date codes or serial numbers of electronic circuit assemblies, must not be older than 12 months from the scheduled installation start date. Material substitutions must not deviate from the material list approved by the Engineer.

##### **86-5.01F(1)(d)(ii) Warranty**

Furnish a 3-year replacement warranty from the manufacturer of VIS and VDU against defects in materials and workmanship or failures. The effective date of the warranty is the date of acceptance of the installation. Submit all warranty documentation before installation.

Replacement VIS and VDU must be furnished within 10 days of receipt of a failed unit. The Department does not pay for replacement.

Deliver replacement VIS and VDU to Caltrans Maintenance Electrical Shop at: 7316 E. Bandini Blvd., Commerce, Ca 90040.

#### **86-5.01F(2) Materials**

##### **86-5.01F(2)(a) General**

VIVDS must include necessary firmware, hardware, and software for designing the detection patterns or zones at the intersection or approach. Detection zones must be created with a graphic user interface designed to allow to anyone trained in VIVDS system setup to configure and calibrate a lane in less than 15 minutes.

System elements must comply with the manufacturer's recommendations and be designed to operate continuously in an outdoor environment.

Equipment, cables, and hardware must be part of an engineered system that is designed by the manufacturer to fully interoperate with other system components. Mounting assemblies must be corrosion resistant. Connectors installed outside the cabinets and enclosures must be corrosion resistant, weather proof, and watertight. Exposed cables must be sunlight and weather resistant.

##### **86-5.01F(2)(a)(i) Physical and Mechanical Requirements**

VIVDS must include:

1. VIS and mounting hardware. Use a clamping device as mounting hardware on a pole or mast-arm.
2. VDU
3. Power supply
4. Surge suppression
5. Cables
6. Connectors
7. Wiring for connecting to the Department-furnished Model 332L traffic controller cabinet
8. Communication card

**86-5.01F(2)(a)(ii) Electrical**

VIVDS must operate between 90 and 135 V(ac) service as specified in NEMA TS-1. VIS, excluding the heater circuit, must draw less than 10 W of power. Power supply or transformer for the VIVDS must meet the following minimum requirements:

**Minimum Requirements for Power Supply and Transformers**

Item	Power Supply	Transformer
Power Cord	Standard 120 V(ac), 3 prong cord, 3 feet minimum length (may be added by Contractor)	Standard 120 V(ac), 3 prong cord, 3 feet minimum length (may be added by Contractor)
Type	Switching mode type	Class 2
Rated Power	Two times (2x) full system load	Two times (2x) full system load
Operating Temperature	From -37 to 74 °C	From -37 to 74 °C
Operating Humidity Range	From 5 to 95 percent	From 5 to 95 percent
Input Voltage	From 90 to 135 V(ac)	From 90 to 135 V(ac)
Input Frequency	60 ± 3 Hz	60 ± 3 Hz
Inrush Current	Cold start, 25 A Max. at 115 V(ac)	N/A
Output Voltage	As required by VIVDS	As required by VIVDS
Overload Protection	From 105 to 150 percent in output pulsing mode	Power limited at >150 percent
Over Voltage Protection	From 115 to 135 percent of rated output voltage	N/A
Setup, Rise, Hold Up	800 ms, 50 ms, 15 ms at 115 V(ac)	N/A
Withstand Voltage	I/P-0/P:3 kV, I/P-FG:1.5 kV, for 60 s.	I/P-0/P:3 kV, I/P-FG:1.5 kV, for 60 s
Working Temperature	Not to exceed 70°C at 30 percent load	Not to exceed 70 °C at 30 percent load
Safety Standards	UL 1012, UL 60950	UL 1585

Field terminated circuits must include transient protection as specified in IEEE Standard 587-1980, Category C. Video connections must be isolated from ground.

**86-5.01F(2)(a)(iii) Technical Requirements**

Camera and zoom lens assembly must be housed in an environmentally sealed enclosure that complies with NEMA 4 standards. Enclosure must be watertight and protected from dust. Enclosure must include a thermostat controlled heater to prevent condensation and to ensure proper lens operation at low temperatures. Adjustable sun shield that diverts water from the camera's field of view must be included. Connectors, cables and wiring must be enclosed and protected from weather. An environmentally sealed (protected from dust and moisture ingress) connector must be used at the rear plate of the housing. Wiring to the connector must be sealed with silicone or putty compound.

Each camera and its mounting hardware must be less than 10 pounds and less than 1 square foot equivalent pressure area. Only 1 camera must be mounted on a traffic signal or luminaire arm. Top of camera must not be more than 12 inches above top of luminaire arm or 30 inches above top of traffic signal arm.

VIS must use a charge-coupled device (CCD) element, support National Television Standards Committee (NTSC) and SMPTE-170M video output formats, and have a horizontal resolution of at least 360 lines. VIS must include an auto gain control (AGC) circuit, have a minimum sensitivity to scene luminance from 0.01 to 930 foot-candle, and produce a usable video image of vehicular traffic under all roadway lighting conditions regardless of the time of day. VIS must have a motorized lens with variable focus and zoom

control with an aperture of f/1.4 or better. Focal length must allow  $\pm 50$  percent adjustment of the viewed detection scene.

A flat panel video display with a minimum 8-inch screen and that supports NTSC video output must be enclosed in the Model 332L controller cabinet for viewing video detector images and for performing diagnostic testing. Display must be viewable in direct sunlight. Each VIVDS must have video system connections that support the NTSC video output format, can be seen in each camera's field of view, and has a program to allow the user to switch to any video signal at an intersection. A metal shelf or pull-out document tray with metal top capable of supporting the VDU and monitor must be furnished and placed on an EIA 19 inch rack with 10-32 "Universal Spacing" threaded holes in the Model 332L controller cabinet. System must allow independent viewing of a scene while video recording other scenes without interfering with the operation of the system's output.

Mounting hardware must be powder-coated aluminum, stainless steel, or treated to withstand 250 hours of salt fog exposure as specified in ASTM B 117 without any visible corrosion damage.

VDU must operate between  $-37$  and  $+74$  degrees C and from 0 to 95 percent relative humidity.

VDU front panel must have indicators for power, communication, presence of video input for each VIS, and a real time detector output operation. Hardware or software test switch must be included to allow the user to place either a constant or momentary call for each approach. Indicators must be visible in daylight from 5 feet away.

VDU must have a serial communication port, TIA 232/USB 2.0 that supports sensor unit setup, diagnostics, and operation from a local PC compatible laptop with Windows 7 or later version operating system. VIVDS must have an Ethernet communication environment, including Ethernet communication card. VIVDS must include central and field software to support remote real-time viewing and diagnostics for operational capabilities through wide area network (WAN).

VDU, image processors, extension modules, and video output assemblies must be inserted into the controller input file slots using the edge connector to obtain limited 24 V(dc) power and to provide contact closure outputs. Cabling the output file to a "D" connector on the front of the VDU is acceptable. No rewiring to the standard Model 332L controller cabinet is allowed. Controller cabinet resident modules must comply with the requirements in Chapter 1 and Sections 5.2.8, 5.2.8.1, 5.2.8.2, 5.4.1, 5.4.5, 5.5.1, 5.5.5, and 5.5.6 of TEES.

#### **86-5.01F(2)(a)(iv) Functional Requirements**

VIVDS must support normal operation of existing detection zones while a zone is being added or modified. Zone must flash or change color on a viewing monitor when vehicular traffic is detected. Length and width of each detection zone for each lane must be approved by the Engineer.

Software and firmware must detect vehicular traffic presence, provide vehicle counts, set up detection zones, test VIVDS performance, and allow video scene and system operation viewing from the local traffic management center/office. VIVDS must support a minimum of 2 separate detection patterns or zones that can be enacted by a remote operator at the signal controller cabinet.

VIVDS detection zone must detect vehicles by providing an output for presence and pulse. At least one detection output must be provided for each detection zone. One spare detection output must be provided for each approach. Detection performance must be achieved for each detection zone with a maximum of 8 user-defined zones for every camera's field of view.

VIVDS must detect the presence of vehicles under all types of adverse weather and environmental conditions, including snow, hail, fog, dirt, dust or contaminant buildup on the lens or faceplate, minor camera motion due to winds, and vibration. Under low visibility conditions, the VIVDS must respond by selecting a fail-safe default pattern, placing a constant call mode for all approaches. VIVDS outputs must assume a fail-safe "on" or "call" pattern for presence detection if video signal or power is not available and must recover from a power failure by restoring normal operations within 3 minutes without manual intervention. If powered off for more than 90 days, system must maintain the configuration and calibration information in memory.

Detection algorithm must be designed to accommodate naturally occurring lighting and environment changes, specifically the slow moving shadows cast by buildings, trees, and other objects. These

changes must not result in a false detection or mask a true detection. VIVDS must not require manual interventions for day-night transition or for reflections from poles, vehicles or pavement during rain and weather changes. VIVDS must suppress blooming effects from vehicle headlights and bright objects at night.

Vehicle detection must call service to a phase only if a demand exists and extend green service to the phase until the demand is taken care of or until the flow rates have reduced to levels for phase termination. VIVDS must detect the presence of vehicular traffic at the detection zone positions and provide the call contact outputs to the Model 170E or Model 2070 controller assembly with the following performance:

<b>Detector Performance</b>		
Requirements	Performance during AMBER and RED interval	Performance during GREEN interval
Average response time after vehicle enters 3 feet into detection zone or after exiting 3 feet past detection zone	≤ 1 s	≤ 100 ms
Maximum number of MISSED CALLS in 24-hour duration, where MISSED CALLS are greater than 5 s during AMBER and RED intervals and greater than 1 s during GREEN intervals (upon entering 3 feet of detection zone or after exiting 3 feet past detection zone).	0	10
Maximum number of FALSE CALLS in 24-hour duration (calls greater than 500 ms without a vehicle present)	20	20

VIVDS must be able to locally store, for each lane, vehicle count data in 5, 15, 30, and 60-minute intervals for a minimum period of 7 days and be remotely retrievable. VIVDS must count vehicular traffic in detection zone with a 95 percent accuracy or better for every hour counted over a morning or an evening peak hour. VIVDS detection zone tested must have a minimum range of 50 feet behind the limit line for each approach. Testing period will be pre-approved by the Engineer 48 hours in advance.

**86-5.01F(3) Construction**

Install VDU in a Department-furnished Model 170E or Model 2070 controller assembly. Install VIS power supply or transformer on a standard DIN rail using standard mounting hardware and power conductors wired to DIN rail mounted terminal blocks in the controller cabinet.

Wiring must be routed through end caps or existing holes. New holes for mounting or wiring must be shop-drilled.

Wire each VIS to the controller cabinet with a wiring harness that includes power, control wiring, and coaxial video cable. Attach harness with standard MIL type and rated plugs. Cable type and wire characteristics must comply with manufacturer's recommendations for the VIS to cabinet distance. Wiring and cables must be continuous, without splices, between the VIS and controller cabinet. Coil a minimum of 7 feet of slack in the bottom of the controller cabinet. For setup and diagnostic access, terminate serial data communication output conductors at TB-0 and continue for a minimum of 10 feet to a DE9F connector. Tape ends of unused and spare conductors to prevent accidental contact to other circuits.

Label conductors inside the cabinet for the functions depicted in the approved detailed diagrams. Label cables with permanent cable labels at each end.

Adjust the lens to view 110 percent of the largest detection area dimension. Zones or elements must be logically combined into reporting contact outputs that are equivalent to the detection loops and with the detection accuracy required.

Verify the performance of each unit, individually, and submit the recorded average and necessary material at the conclusion of the performance test. Determine and document the accuracy of each unit, individually, so that each unit may be approved or rejected separately. Failure to submit necessary material at the conclusion of testing invalidates the test. The recorded media serves as acceptance evidence and must not be used for calibration. Calibration must have been completed before testing and verification.

Verify the detection accuracy by observing the VIVDS performance and recorded video images for a contiguous 24-hour period. The recorded video images must show the viewed detection scene, the detector call operation, the signal phase status for each approach, the vehicular traffic count, and time-stamp to 1/100 of a second, all overlaid on the recorded video. Transfer the 24-hour analysis to DVD.

VIVDS must meet the detection acceptance criterion specified in table titled "Detector Performance."

Calculate the VIVDS's vehicular traffic count accuracy as:  $100[1-(|TC-DC|/TC)]$ , where DC is the detector's vehicular traffic count and TC is the observed media-recorded vehicular traffic count and where the resulting fraction is expressed as an absolute value.

The Engineer will review the data findings and accept or reject the results within 7 days. Vehicle anomalies or unusual occurrences will be decided by the Engineer. Data or counts not agreed by the Engineer will be considered errors and count against the unit's calibration. If the Engineer determines that the VIVDS does not meet the performance requirements, you must re-calibrate and retest the unit, and resubmit new test data within 7 days. After 3 failed attempts, you must replace the VIVDS with a new unit.

Notify the Engineer 20 days before the unit is ready for acceptance testing. Acceptance testing must be scheduled to be completed before the end of a normal work shift. You must demonstrate that all VIS and VDUs satisfy the functional requirements.

#### **86-5.01F(4) Payment**

Not Used

#### **Replace "Reserved" in section 86-5.03 of the RSS with:**

##### **86-5.03A General**

##### **86-5.03A(1) Summary**

Section 86-5.03 includes specifications for installing accessible pedestrian signals (APS). Comply with TEES.

##### **86-5.03A(2) Definitions**

**accessible pedestrian signal:** Accessible pedestrian signal as defined in the *California MUTCD*.

**accessible walk indication:** Activated audible and vibrotactile action during the walk interval.

**ambient sound level:** Background sound level in dB at a given location.

**ambient sound sensing microphone:** Microphone that measures the ambient sound level in dB and automatically adjusts the APS speaker's volume.

**APS assembly:** Assembly that includes a pushbutton to actuate the APS components.

**audible speech walk message:** Audible prerecorded message that communicates to pedestrians which street has the walk interval.

**programming mechanism:** Device to program the APS' operation.

**pushbutton information message:** Pushbutton information message as defined in the *California MUTCD*.

**pushbutton locator tone:** Pushbutton locator tone as defined in the *California MUTCD*.

**vibrotactile pedestrian device:** Vibrotactile pedestrian device as defined in the *California MUTCD*.

### **86-5.03A(3) Submittals**

Before shipping the APS units to the job site, submit the units with the following to METS:

1. Delivery form including Contract number and your contact information
2. Manufacturer's name
3. Model, lot, and serial numbers
4. Month and year of manufacture
5. Wiring diagram
6. Product data
7. Programming mechanism if not integral to the APS

Submit 4 APS user and operator manuals for each signalized location as informational submittals. Each manual must have a master item index that includes:

1. Descriptions of the APS and its associated equipment and cables
2. Illustrative block diagrams
3. Manufacturer's contact information
4. Technical data specifications
5. Parts list, descriptions, and settings
6. Fault diagnostic and repair procedures
7. Preventative maintenance procedures for maintaining APS performance parameters

Submit the manufacturer's warranty documentation as an informational submittal before installing the APS.

Submit a record of completed field tests, the APS' final configuration, audible sound level and threshold, and a list of all parameter settings.

### **86-5.03A(4) Quality Control and Assurance**

#### **86-5.03A(4)(a) General**

The APS must be compatible with the Department-furnished Model 170E/2070L controller assembly.

The power to the APS must be connected to the pedestrian signal's terminal blocks.

#### **86-5.03A(4)(b) Functional Testing**

Perform 2 field tests on the APS: (1) when traffic is noisy during peak traffic hours and (2) when traffic is quiet during off-peak hours. Notify the Engineer 15 days before testing the APS.

#### **86-5.03A(4)(c) Warranty**

The APS must have a 2-year manufacturer's warranty against any defects or failures. The 2-year warranty period starts at Contract acceptance. Deliver a replacement within 10 days after you receive notification of a failed APS. The Department does not pay for the replacement. Deliver the replacement to the Department's Maintenance Electrical Shop at:

7316 E Bandini Blvd.,  
Commerce, CA 90040  
Tel (213) 620-2194

#### **86-5.03A(4)(d) Training**

Provide a minimum of 16 hours of training by a certified manufacturer's representative for up to 4 Department employees selected by the Engineer. The training must include instruction in installing, programming, adjusting, calibrating, and maintaining the APS.

Furnish materials and equipment for the training.

### **86-5.03B Materials**

The housing for the APS assembly must be made of corrosion-resistant material. Theftproof bolts used for mounting the APS housing to the standard must be stainless steel with a chromium content of 17 percent and a nickel content of 8 percent.

The color of metallic housing must match color no. 33538 of FED-STD-595.

The color of plastic housing must match color no. 17038, 27038, or 37038 of FED-STD-595.

The APS assembly must be rainproof and shockproof in any weather condition.

The APS assembly must include:

1. Pushbutton actuator with a minimum diameter of 2 inches. If a mechanical switch is used, it must have:
  - 1.1. Operating force of 3.5 lb
  - 1.2. Maximum pretravel of 5/64 inch
  - 1.3. Minimum overtravel of 1/32 inch
  - 1.4. Differential travel from 0.002 to 0.04 inch
2. Vibrotactile device on the pushbutton or on the arrow.
3. Enclosure with an ambient-sound-level-sensing microphone and weatherproof speaker. The enclosure must:
  - 3.1 Weigh less than 7 lb.
  - 3.2 Measure less than 16 by 6 by 5 inches.
  - 3.3 Fit the standard.
  - 3.4 Have a wiring hole with a diameter not exceeding 1-1/8 inches.
  - 3.5 Be attached to the pole with 2 screws with a diameter from 1/4 to 3/8 inch suitable for use in tapped holes. The clear space between any 2 holes in the post must be at least twice the diameter of the larger hole.
4. Pushbutton sign.

The APS speakers and electronic equipment must be installed inside the APS assembly's enclosure. The speaker grills must be located on the surface of the enclosure.

Speakers must not interfere with the housing or its mounting hardware.

The conductor cable between the APS assembly and the pedestrian signal head must be a no. 9, 20-conductor cable complying with MIL-W-16878D. The wiring must comply with section 13.02 of ITE publication *Equipment and Material Standards* chapter 2, "Vehicle Traffic Control Signal Heads," and be NEC rated for service at +105 degrees C.

The APS must:

1. Include a mechanism for enabling and disabling its operation.
2. Have electronic switches, a potentiometer, or a handheld device for controlling and programming the volume level and messaging. Deliver any handheld programming device to the Engineer.
3. Provide information using:
  - 3.1 Audible speech message that plays when the pushbutton is actuated. The message must include the name of the street to be crossed. The APS must have at least 5 audible message options. The Engineer selects the message. The message must have a percussive tone consisting of multiple frequencies with a dominant component of 880 Hz. If the tone is selected as the message, it must repeat 8 to 10 ticks per second.
  - 3.2. Pushbutton locator tone that clicks or beeps. The pushbutton must produce the locator tone at an interval of 1 tone per second. Each tone must have a maximum duration of 0.15 second. The tone volume must adjust in response to the ambient sound level and be audible up to 12 feet from the pushbutton or to the building line, whichever is less.
4. Have a pushbutton that remains functional during an APS failure.

For signalized intersections, the APS must:

1. Have a pushbutton that when actuated activates the pedestrian walk signal's timing during an APS failure.
2. Provide information using:
  - 2.1. Audible speech walk message. The message must be activated from the beginning of the walk interval and repeated for its duration. An example of the message is "Peachtree. Walk sign is on to cross Peachtree."

- 2.2. Pushbutton information message that provides the name of the street to be crossed. The message must play when the pushbutton is actuated. An example of the message is "Wait to cross Howard at Grand. Wait."
3. Have a functional pushbutton that activates the pedestrian walk signal whenever actuated, even if the audible speech walk message, the pushbutton information message, the pushbutton locator tone, and the vibrating surface features are disabled.

For unsignalized pedestrian crossings, the APS must have an audible speech message such as "Peachtree. Cross with caution."

#### **86-5.03C Construction**

Arrange to have a manufacturer's representative at the job site when the APS is installed, modified, connected, or reconnected. The APS must not interfere with the Department-furnished controller assembly, the signal installation on signal standards, the pedestrian signal heads, or the terminal compartment blocks. The APS electronic control equipment must reside inside the APS assembly and the standard pedestrian signal head.

You are responsible for the compatibility of the components and for making the necessary calibration adjustments to deliver the performance specified. Furnish the equipment and hardware, and then set up, calibrate, and verify the performance of the APS.

Point arrows on the pushbutton signs in the same direction as the corresponding crosswalk. Attach the sign to the APS assembly.

Do not install an APS on a standard smaller than Type 1-A.

#### **86-5.03D Payment**

Not Used

### **Replace section 86-6.02 with:**

#### **86-6.02 LED LUMINAIRES**

##### **86-6.02A General**

##### **86-6.02A(1) Summary**

Section 86-6.02 includes specifications for installing LED luminaires.

##### **86-6.02A(2) Definitions**

**CALiPER:** Commercially Available LED Product Evaluation and Reporting. A U.S. DOE program that individually tests and provides unbiased information on the performance of commercially-available LED luminaires and lights.

**correlated color temperature:** Absolute temperature in kelvin of a blackbody whose chromaticity most nearly resembles that of the light source.

**house side lumens:** Lumens from a luminaire directed to light up areas between the fixture and the pole, such as sidewalks at intersection or areas off the shoulders on freeways.

**International Electrotechnical Commission (IEC):** Organization that prepares and publishes international standards for all electrical, electronic, and related technologies.

**junction temperature:** Temperature of the electronic junction of the LED device. The junction temperature is critical in determining photometric performance, estimating operational life, and preventing catastrophic failure of the LED.

**L70:** Extrapolated life in hours of the luminaire when the luminous output depreciates 30 percent from initial values.

**LM-79:** Test method from the Illumination Engineering Society of North America specifying test conditions, measurements, and report format for testing solid state lighting devices, including LED luminaires.

**LM-80:** Test method from the Illumination Engineering Society of North America specifying test conditions, measurements, and report format for testing and estimating the long-term performance of LEDs for general lighting purposes.

**National Voluntary Laboratory Accreditation Program (NVLAP):** U.S. DOE program that accredits independent testing laboratories.

**power factor:** Ratio of the real power component to the complex power component.

**street side lumens:** Lumens from a luminaire directed to light up areas between the fixture and the roadway, such as traveled ways and freeway lanes.

**surge protection device (SPD):** Subsystem or component that protects the unit against short-duration voltage and current surges.

**total harmonic distortion:** Ratio of the rms value of the sum of the squared individual harmonic amplitudes to the rms value of the fundamental frequency of a complex waveform.

### **86-6.02A(3) Submittals**

Submit a sample luminaire to METS for testing after the manufacturer's testing is completed. Include the manufacturer's test data.

Product submittals must include:

1. LED luminaire checklist.
2. Product specification sheets, including:
  - 2.1. Maximum power in watts.
  - 2.2. Maximum designed junction temperature.
  - 2.3. Heat sink area in square inches.
  - 2.4. Designed junction to ambient thermal resistance calculation with thermal resistance components clearly defined.
  - 2.5. L70 in hours when extrapolated for the average nighttime operating temperature.
3. LM-79 and LM-80 compliant test reports from a CALiPER-qualified or NVLAP-approved testing laboratory for the specific model submitted.
4. Photometric file based on LM-79 test report.
5. Initial and depreciated isofootcandle diagrams showing the specified minimum illuminance for the particular application. The diagrams must be calibrated to feet and show a 40 by 40 foot grid. The diagrams must be calibrated to the mounting height specified for that particular application. The depreciated isofootcandle diagrams must be calculated at the minimum operational life.
6. Test report showing SPD performance as tested under ANSI/IEEE C62.41.2 and ANSI/IEEE C62.45.
7. Test report showing mechanical vibration test results as tested under California Test 611 or equal.
8. Data sheets from the LED manufacturer that include information on life expectancy based on junction temperature.
9. Data sheets from the power supply manufacturer that include life expectancy information.

Submit documentation of a production QA performed by the luminaire manufacturer that:

1. Ensures the minimum specified performance level
2. Includes a documented process for resolving problems

Submit the QA documentation as an informational submittal.

Submit the manufacturer's warranty documentation as an informational submittal before installing LED luminaires.

### **86-6.02A(4) Quality Control and Assurance**

#### **86-6.02A(4)(a) General**

The Department may test random samples of the luminaires under section 86-2.14A. The Department tests luminaires under California Test 678 and may test any parameters specified in section 86-6.01.

Fit 1 sample luminaire with a thermistor or thermocouple temperature sensor. A temperature sensor must be mounted on the:

1. LED solder pad as close to the LED as possible
2. Power supply case
3. Light bar or modular system as close to the center of the module as possible

Other configurations must have at least 5 sensors per luminaire. The Engineer provides advice on sensor location. Thermocouples must be either Type K or C. Thermistors must be a negative-temperature-coefficient type with a nominal resistance of 20 kΩ. Use the appropriate thermocouple wire. The leads must be a minimum of 6 feet. Submit documentation with the test unit describing the type of sensor used.

Before performing any testing, energize the sample luminaires for a minimum of 24 hours at 100 percent on-time duty cycle and a temperature of +70 degrees F.

Depreciate the luminaire lighting's performance for the minimum operating life by using the LED manufacturer's data or the data from the LM-80 test report, whichever results in a higher lumen depreciation.

Failure of the luminaire that renders the unit noncompliant with section 86-6.02 specifications is cause for rejection.

**86-6.02A(4)(b) Warranty**

Provide a 7-year manufacturer's warranty against any defects or failures. The warranty period begins on the date of Contract acceptance. Furnish a replacement luminaire within 10 days after receipt of the failed luminaire. The Department does not pay for the replacement. Deliver replacement luminaires to the Department's Maintenance Electrical Shop at:

7316 E Bandini Blvd.,  
Commerce, CA 90040  
Tel (213) 620-2194

**86-6.02B Materials**

**86-6.02B(1) General**

The luminaire must include an assembly that uses LEDs as the light source. The assembly must include a housing, an LED array, and an electronic driver. The luminaire must:

1. Be UL listed under UL 1598 for luminaires in wet locations or an equivalent standard from a recognized testing laboratory
2. Have a minimum operational life of 63,000 hours
3. Operate at an average operating time of 11.5 hours per night
4. Be designed to operate at an average nighttime operating temperature of 70 degrees F
5. Have an operating temperature range from -40 to +130 degrees F
6. Be defined by the following applications:

Application	Replaces
Roadway 1	200 W high-pressure sodium luminaire mounted at 34 ft
Roadway 2	310 W high-pressure sodium luminaire mounted at 40 ft
Roadway 3	310 W high-pressure sodium luminaire mounted at 40 ft with back side control
Roadway 4	400 W high-pressure sodium luminaire mounted at 40 ft

The individual LEDs must be connected such that a catastrophic loss or a failure of 1 LED does not result in the loss of more than 20 percent of the luminous output of the luminaire.

**86-6.02B(2) Luminaire Identification**

Each luminaire must have the following identification permanently marked inside the unit and outside of its packaging box:

1. Manufacturer's name
2. Trademark
3. Model number
4. Serial number
5. Month and year of manufacture
6. Lot number
7. Contract number
8. Rated voltage
9. Rated wattage
10. Rated power in VA

**86-6.02B(3) Electrical Requirements**

The luminaire must operate from a 60 ± 3 Hz AC power source. The fluctuations of line voltage must have no visible effect on the luminous output. The operating voltage may range from 120 to 480 V(ac). The luminaire must operate over the entire voltage range or the voltage range must be selected from either of the following options:

1. Luminaire must operate over a voltage range of 95 to 277 V(ac). The operating voltages for this option are 120 V(ac) and 240 V(ac).
2. Luminaire must operate over a voltage range of 347 to 480 V(ac). The operating voltage for this option is 480 V(ac).

The power factor of the luminaire must be 0.90 or greater. The total harmonic distortion, current, and voltage induced into an AC power line by a luminaire must not exceed 20 percent. The maximum power consumption allowed for the luminaire must be as shown in the following table:

Application	Maximum consumption (watts)
Roadway 1	165
Roadway 2	235
Roadway 3	235
Roadway 4	300

**86-6.02B(4) Surge Suppression and Electromagnetic Interference**

The luminaire's on-board circuitry must include an SPD to withstand high repetition noise transients caused by utility line switching, nearby lightning strikes, and other interferences. The SPD must protect the luminaire from damage and failure due to transient voltages and currents as defined in Tables 1 and 4 of ANSI/IEEE C64.41.2 for location category C-High. The SPD must comply with UL 1449. The SPD must be tested under ANSI/IEEE C62.45 based on ANSI/IEEE C62.41.2 definitions for standard and optional waveforms for location category C-High.

The luminaires and associated on-board circuitry must comply with the Class A emission limits under 47 CFR 15, subpart B, for the emission of electronic noise.

**86-6.02B(5) Compatibility**

The luminaire must be operationally compatible with currently-used lighting control systems and photoelectric controls.

**86-6.02B(6) Photometric Requirements**

The luminaire must maintain a minimum illuminance level throughout the minimum operating life. The L70 of the luminaire must be the minimum operating life or greater. The measurements must be calibrated to standard photopic calibrations. The minimum maintained illuminance values measured at a point must be as shown in the following table:

Application	Mounting height (ft)	Minimum maintained illuminance (fc)	Light pattern figure (isofootcandle curve)
Roadway 1	34	0.15	<p>Pattern defined by an ellipse with the equation:</p> $\frac{x^2}{(82)^2} + \frac{(y - 20)^2}{(52)^2} = 1$ <p>where:  x = direction longitudinal to the roadway  y = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 20 feet to the house side of the pattern.</p>
Roadway 2	40	0.2	<p>Pattern defined by an ellipse with the equation:</p> $\frac{x^2}{(82)^2} + \frac{(y - 20)^2}{(52)^2} = 1$ <p>where:  x = direction longitudinal to the roadway  y = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 20 feet to the house side of the pattern.</p>
Roadway 3	40	0.2	<p>Pattern defined by an ellipse with the equation:</p> $\frac{x^2}{(82)^2} + \frac{(y - 20)^2}{(52)^2} = 1$ <p>for <math>y \geq 0</math> (street side)</p> <p>where:  x = direction longitudinal to the roadway  y = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 20 feet to the house side of the pattern.</p>
Roadway 4	40	0.2	<p>Pattern defined by an ellipse with the equation:</p> $\frac{x^2}{(92)^2} + \frac{(y - 23)^2}{(55)^2} = 1$ <p>where:  x = direction longitudinal to the roadway  y = direction transverse to the roadway and the luminaire is offset from the center of the pattern by 23 feet to the house side of the pattern.</p>

The luminaire must have a correlated color temperature range from 3,500 to 6,500 K. The color rendering index must be 65 or greater.

The luminaire must not allow more than:

1. 10 percent of the rated lumens to project above 80 degrees from vertical
2. 2.5 percent of the rated lumens to project above 90 degrees from vertical

### 86-6.02B(7) Thermal Management

The passive thermal management of the heat generated by the LEDs must have enough capacity to ensure proper operation of the luminaire over the minimum operation life. The LED maximum junction temperature for the minimum operation life must not exceed 221 degrees F.

The junction-to-ambient thermal resistance must be 95 degrees F per watt or less. The use of fans or other mechanical devices is not allowed. The heat sink material must be aluminum or other material of equal or lower thermal resistance.

The luminaire must contain circuitry that automatically reduces the power to the LEDs so the maximum junction temperature is not exceeded when the ambient outside temperature is 100 degrees F or greater.

### 86-6.02B(8) Physical and Mechanical Requirements

The luminaire must:

1. Be a single, self-contained device not requiring job-site assembly for installation
2. Have an integral power supply
3. Weigh no more than 35 lb
4. Have a maximum-effective projected area of 1.4 sq ft when viewed from either side or end
5. Have a housing color that matches color number from 26152 to 26440, from 36231 to 36375, or 36440 of FED-STD-595.

The housing must be fabricated from materials designed to withstand a 3,000-hour salt spray test under ASTM B 117. All aluminum used in housings and brackets must be made of a marine-grade alloy with less than 0.2 percent copper. All exposed aluminum must be anodized.

Each refractor or lens must be made from UV-inhibited high-impact plastic such as acrylic or polycarbonate or heat- and impact-resistant glass and be resistant to scratching. Polymeric materials except lenses of enclosures containing either the power supply or electronic components of the luminaire must be made of UL94VO flame retardant materials. The housing's paint must comply with section 86-2.16. A chromate conversion undercoating must be used underneath a thermoplastic polyester powder coat.

Provide each housing with a slip fitter capable of mounting on a 2-inch pipe tenon. This slip fitter must fit on mast arms with outside diameters from 1-5/8 to 2-3/8 inches. The slip fitter must be capable of being adjusted a minimum of  $\pm 5$  degrees from the axis of the tenon in a minimum of 5 steps: +5, +2.5, 0, -2.5, -5. The clamping brackets of the slip fitter must not bottom out on the housing bosses when adjusted within the designed angular range. No part of the slip fitter's mounting brackets must develop a permanent set in excess of 1/32 inch when the bracket's two or four 3/8-inch-diameter cap screws are tightened to 10 ft-lb. Two sets of cap screws may be furnished to allow the slip fitter to be mounted on the pipe tenon in the acceptable range without the cap screws bottoming out in the threaded holes. The cap screws and the clamping brackets must be made of corrosion-resistant materials or treated to prevent galvanic reactions and be compatible with the luminaire housing and the mast arm.

The LED luminaire must be assembled and manufactured such that its internal components are adequately supported to withstand mechanical shock and vibration from high winds and other sources. When tested under California Test 611, the luminaire to be mounted horizontally on the mast arm must be capable of withstanding the following cyclic loading for a minimum of 2 million cycles without failure of any luminaire part:

#### Cyclic Loading

Plane	Power supply	Minimum peak acceleration level
Vertical	Installed	3.0 g peak-to-peak sinusoidal loading (same as 1.5 g peak)
Horizontal <sup>a</sup>	Installed	1.5 g peak-to-peak sinusoidal loading (same as 0.75 g peak)

<sup>a</sup>Perpendicular to the direction of the mast arm

The housing must be designed to prevent the buildup of water on top of the housing. Exposed heat sink fins must be oriented to allow water to freely run off of the luminaire and carry dust and other accumulated debris away from the unit. The optical assembly of the luminaire must be protected against

dust and moisture intrusion to at least an ANSI/IEC rating of IP66. The power supply enclosure must be protected to at least an ANSI/IEC rating of IP43.

Furnish each mounted luminaire with an ANSI C136.10-compliant, locking-type photocontrol receptacle and a raintight shorting cap. The receptacle must comply with section 86-6.11A.

When the components are mounted on a down-opening door, the door must be hinged and secured to the luminaire housing separately from the refractor or flat lens frame. The door must be secured to the housing such that accidental opening is prevented. A safety cable must mechanically connect the door to the housing.

Field wires connected to the luminaire must terminate on a barrier-type terminal block secured to the housing. The terminal screws must be captive and equipped with wire grips for conductors up to no. 6. Each terminal position must be clearly identified.

The power supply must be rated for outdoor operation and have at least an ANSI/IEC rating of IP65.

The power supply must be rated for a minimum operational life equal to the minimum operational life of the luminaire or greater.

The power supply case temperature must have a self rise of 77 degrees F or less above ambient temperature in free air with no additional heat sinks.

The power supply must have 2 leads to accept standard 0-10 V(dc). The dimming control must be compatible with IEC 60929. If the control leads are open or the analog control signal is lost, the circuit must default to 100-percent power.

Conductors and terminals must be identified.

#### **86-6.02C Construction**

Not Used

#### **86-6.02D Payment**

Not Used

**Replace the 3rd item of the 1st paragraph of section 86-6.09 with:**

3. Type A sign

**Add to section 86-6:**

#### **86-6.14 LIGHTING (UNION PACIFIC RAILROAD)**

##### **86-6.14A General**

##### **86-6.14A(1) Summary**

This work consists of installing soffit lighting system under the bridge deck.

##### **86-6.14A(2) Quality Control And Assurance**

Not Used.

##### **86-6.14A(3) Submittals**

Submit working drawings for approval. Working drawings must show the shape, size, and method of attachment for each component used in the work.

##### **86-6.14B Materials**

All conduits and fittings must be Type 1.

Conductors must be stranded copper wire. Conductor insulation must be Type XHHW-2. Conductors must be rated for 600 V(ac).

Conductors must be identified as follows:

1. Neutral conductor must have white insulation.



# DIVISION X MATERIALS

## 87 MATERIALS—GENERAL

Replace section 87-2 with:

### 87-2 AGGREGATE

#### 87-2.01 GENERAL

##### 87-2.01A Summary

Section 87-2 includes specifications for furnishing aggregate.

##### 87-2.01B Definitions

**stockpile lot:** Stockpile or portion of a stockpile of steel slag aggregate used.

##### 87-2.01C Submittals

Submit a certificate of compliance for:

1. Each stockpile lot
2. Steel slag

#### 87-2.02 MATERIALS

##### 87-2.02A General

Do not use air-cooled iron blast furnace slag to produce aggregate for:

1. Structure backfill material
2. Pervious backfill material
3. Permeable material
4. Reinforced or prestressed PCC component or structure
5. Nonreinforced PCC component or structure for which a Class 1 surface finish under section 51-1.03F(3) is required

Do not use aggregate produced from slag resulting from a steel-making process except in:

1. Imported borrow
2. AS
3. Class 2 AB
4. HMA

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

For steel slag aggregate, provide separate stockpiles for controlled aging of the slag. An individual stockpile must not contain less than 10,000 tons or more than 50,000 tons of slag. The material in each individual stockpile must be assigned a unique lot number, and each stockpile must be identified with a permanent system of signs. Maintain a permanent record of:

1. Dates for:
  - 1.1. Completion of stockpile
  - 1.2. Start of controlled aging
  - 1.3. Completion of controlled aging
  - 1.4. Making of tests
2. Test results

For each stockpile of steel slag aggregate, moisture tests must be made at least once each week. The time covered by tests that show a moisture content of 6 percent or less is not included in the aging time.



## 88 GEOSYNTHETICS

### Add to section 88-1.02B:

Filter fabric for media filters must be Class D.

#### Filter Fabric Class D

Property	Test	Value
Grab breaking load, lb 1-inch grip, min. in each direction	ASTM D 4632	120x120
Apparent elongation, percent min., in each direction	ASTM D 4632	50x50
Permittivity, sec <sup>-1</sup> , minimum and maximum	ASTM D 4491	1.6-1.8
Apparent opening size, U.S. Standard sieve size maximum and minimum	ASTM D 4751	60-80
Ultraviolet resistance, percent minimum retained grab breaking load, 500 hr.	ASTM D4355	70

AA

## 90 CONCRETE

### Add to section 90-1.01C:

#### 90-1.01C(11) Polymer Fibers

Submit fiber manufacturer's product data and instructions for use.

Submit a certificate of compliance for each shipment and type of fibers.

**Replace the row for bridge deck concrete in the table in the 1st paragraph of section 90-1.02A with:**

Bridge deck concrete	0.032
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### Add to section 90-1.02:

#### 90-1.02K Polymer Fibers

Fibers must comply with ASTM D 7508. Microfibers must be from 1/2 to 2 inches long. Macrofibers must be from 1 to 2-1/2 inches long.

### Add to section 90-2.02B:

You may use rice hull ash as an SCM. Rice hull ash must comply with AASHTO M 321 and the chemical and physical requirements shown in the following tables:

Chemical property	Requirement (percent)
Silicon dioxide (SiO <sub>2</sub> ) <sup>a</sup>	90 min
Loss on ignition	5.0 max
Total alkalis as Na <sub>2</sub> O equivalent	3.0 max

Physical property	Requirement
Particle size distribution	
Less than 45 microns	95 percent
Less than 10 microns	50 percent
Strength activity index with portland cement <sup>b</sup>	
7 days	95 percent (min percent of control)
28 days	110 percent (min percent of control)
Expansion at 16 days when testing project materials under ASTM C 1567 <sup>c</sup>	0.10 percent max
Surface area when testing by nitrogen adsorption under ASTM D 5604	40.0 m <sup>2</sup> /g min

<sup>a</sup>SiO<sub>2</sub> in crystalline form must not exceed 1.0 percent.

<sup>b</sup>When tested under AASHTO M 307 for strength activity testing of silica fume.

<sup>c</sup>In the test mix, Type II or V portland cement must be replaced with at least 12 percent rice hull ash by weight.

For the purpose of calculating the equations for the cementitious material specifications, consider rice hull ash to be represented by the variable *UF*.

**Add to the RSS for section 90-4.01C(1):**

Submit temperature data daily for tier 1 PC concrete members as an informational submittal to the Engineer and to METS.

**Add to the list in the 2nd paragraph of the RSS for section 90-4.01C(3):**

10. Thermal control plan for controlling temperature in tier 1 PC concrete members. The thermal control plan must be prepared by the QC inspector and must include the following:
  - 10.1. Authorized mix design
  - 10.2. Duration and method of curing
  - 10.3. Concrete temperature monitoring and recording system details
  - 10.4. Temperature sensor types and locations
  - 10.5. Measures to ensure compliance with maximum temperature and temperature gain requirements including:
    - 10.5.1. Maximum concrete temperature at discharge
    - 10.5.2. Controlling enclosure temperature

**Add to the list in the 3rd paragraph of the RSS for section 90-4.01C(3):**

8. Thermal control plan

**Add to the RSS for section 90-4.01D(2)(c) with:**

For tier 1 PC concrete members, provide a temperature monitoring and recording system during concrete placement and curing. The system must consist of temperature sensors connected to a data acquisition system. The system must be capable of recording, printing, and downloading temperature data to a computer.

At a minimum, monitor internal concrete temperatures at the following locations:

1. Midpoint of member along the bed length with the temperature sensor positioned to provide maximum concrete cover
2. Near each end with the temperature sensor positioned to provide maximum concrete cover

Record temperature readings automatically at least every hour. Install a redundant set of sensors near the primary set with recording capability. Make records using the redundant set if the primary set fails.

You may discontinue hourly temperature recording when the maximum internal concrete temperature is falling and is less than 40 degrees F above the ambient temperature.

Protect the temperature sensor wiring to prevent movement during concrete placement. Keep wire runs as short as possible. Do not allow the ends of temperature sensors come into contact with concrete supports, forms, or reinforcement.

Do not damage the monitoring and recording system when placing and consolidating concrete.

Correct equipment failures in temperature control and monitoring and recording systems immediately.

**Add to section 90-4.02:**

For tier 1 PC concrete members, the maximum allowable internal concrete temperature must not exceed 160 degrees F and the maximum allowable temperature gain must not exceed 40 degrees F per hour at any sensor.

**Replace “200” in item 5 in the list in the 2nd paragraph in section 90-4.03 with:**

100

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



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

10-17-14

MSDS<sup>b</sup>

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

<sup>b</sup>Interpret a reference to MSDS as a reference to SDS under 29 CFR 1910.1200.

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

06-20-12

Delete "Contract completion date" and its definition in section 1-1.07B.

10-19-12

Delete "critical delay" and its definition in section 1-1.07B.

10-19-12

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

10-19-12

**day:** 24 consecutive hours running from midnight to midnight; calendar day.

1. **business day:** Day on the calendar except a Saturday and a holiday.
2. **working day:** Time measure unit for work progress. A working day is any 24-consecutive-hour period except:
  - 2.1. Saturday and holiday.
  - 2.2. Day during which you cannot perform work on the controlling activity for at least 50 percent of the scheduled work shift with at least 50 percent of the scheduled labor and equipment due to any of the following:
    - 2.2.1. Adverse weather-related conditions.
    - 2.2.2. Maintaining traffic under the Contract.
    - 2.2.3. Suspension of a controlling activity that you and the Engineer agree benefits both parties.
    - 2.2.4. Unanticipated event not caused by either party such as:
      - 2.2.4.1. Act of God.
      - 2.2.4.2. Act of a public enemy.
      - 2.2.4.3. Epidemic.
      - 2.2.4.4. Fire.

- 2.2.4.5. Flood.
- 2.2.4.6. Governor-declared state of emergency.
- 2.2.4.7. Landslide.
- 2.2.4.8. Quarantine restriction.
- 2.2.5. Issue involving a third party, including:
  - 2.2.5.1. Industry or area-wide labor strike.
  - 2.2.5.2. Material shortage.
  - 2.2.5.3. Freight embargo.
  - 2.2.5.4. Jurisdictional requirement of a law enforcement agency.
  - 2.2.5.5. Workforce labor dispute of a utility or nonhighway facility owner resulting in a nonhighway facility rearrangement not described and not solely for the Contractor's convenience. Rearrangement of a nonhighway facility includes installation, relocation, alteration, or removal of the facility.
- 2.3. Day during a concurrent delay.
- 3. **original working days:**
  - 3.1. Working days to complete the work shown on the *Notice to Bidders* for a non-cost plus time based bid.
  - 3.2. Working days bid to complete the work for a cost plus time based bid.

Where working days is specified without the modifier "original" in the context of the number of working days to complete the work, interpret the number as the number of original working days as adjusted by any time adjustment.

**Replace "Contract" in the definition of "early completion time" in section 1-1.07B with:**

work 10-19-12

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

**delay:** Event that extends the completion of an activity. 10-19-12

- 1. **excusable delay:** Delay caused by the Department and not reasonably foreseeable when the work began such as:
  - 1.1. Change in the work
  - 1.2. Department action that is not part of the Contract
  - 1.3. Presence of an underground utility main not described in the Contract or in a location substantially different from that specified
  - 1.4. Described facility rearrangement not rearranged as described, by the utility owner by the date specified, unless the rearrangement is solely for the Contractor's convenience
  - 1.5. Department's failure to obtain timely access to the right-of-way
  - 1.6. Department's failure to review a submittal or provide notification in the time specified
- 2. **critical delay:** Excusable delay that extends the scheduled completion date
- 3. **concurrent delay:** Occurrence of at least 2 of the following events in the same period of time, either partially or entirely:
  - 3.1. Critical delay
  - 3.2. Delay to a controlling activity caused by you
  - 3.3. Non-working day

**Replace "project" in the definition of "scheduled completion date" in section 1-1.07B with:**

work 10-19-12

**Replace the definition of "traveled way" in section 1-1.07B with:**

01-15-16

Portion of the roadway for the movement of vehicles, exclusive of the shoulders, berms, sidewalks, and parking lanes.

**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



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](mailto: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 <sup>a</sup>	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

<sup>a</sup>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 <sup>a</sup>	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 <sup>a</sup>	Time of bid
Certified Small Business Listing for the Non-Small Business Preference <sup>a</sup>	No later than 4 p.m. on the 2nd business day after bid opening

<sup>a</sup>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:



**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.

**Delete items 4 and 6 of the 2nd paragraph of section 3-1.18.**

01-23-15

**Delete the 3rd paragraph of section 3-1.18.**

02-27-15



**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.

**Delete the 1st sentence in the 10th paragraph of section 5-1.23B(2).**

07-19-13

**Add to the list in the 1st paragraph of section 5-1.36A:**

07-19-13

10. Survey monuments

**Add to section 5-1.36C:**

07-20-12

If the Contract does not include an agreement with a railroad company, do not allow personnel or equipment on railroad property.

Prevent material, equipment, and debris from falling onto railroad property.

**Add to section 5-1.36:**

07-19-13

**5-1.36E Survey Monuments**

Protect survey monuments on and off the highway. Upon discovery of a survey monument not identified and located immediately:

1. Stop work near the monument
2. Notify the Engineer

Do not resume work near the monument until authorized.

**Add between the 1st and 2nd paragraphs of section 5-1.37A:**

10-19-12

Do not remove any padlock used to secure a portion of the work until the Engineer is present to replace it. Notify the Engineer at least 3 days before removing the lock.





## 7 LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

02-12-16

Replace "§§ 1727 and 1770–1815" in the 1st sentence of the 1st paragraph of section 7-1.02K(1) with:

§ 1720 et seq.

02-27-15

Replace "\$50" in the 1st sentence in the 6th paragraph of section 7-1.02K(2) with:

\$200

07-19-13

Replace "\$25" in the 2nd sentence in the 13th paragraph of section 7-1.02K(3) with:

\$100

07-19-13

Add between the 1st and 2nd sentences in the 2nd paragraph of section 7-1.02K(6)(b):

05-30-14

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.

10-30-15

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:

Flagging must comply with section 12-1. The Department pays you for this work under section 12-1.04.

10-30-15

Add between the 1st and 2nd sentences of the 7th paragraph of section 7-1.04:

Flagging must comply with section 12-1. The Department pays you for this work under section 12-1.04.

10-30-15

Replace "20 days" in the 14th paragraph of section 7-1.04 with:

25 days

09-16-11

Replace "90 days" in the 14th paragraph of section 7-1.04 with:

125 days

09-16-11

**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.

**Delete "lane" in the 2nd sentence in the 27th paragraph of section 7-1.04.**

10-30-15

**Add between the 1st and 2nd paragraphs of section 7-1.11A:**

02-12-16

Comply with 46 CFR 381.7(a)–(b).

**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

- 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.

**ATTACHMENTS**

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

**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.

**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).

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 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.

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.

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.

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.

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).

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.

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.

**1. Equal Employment Opportunity:** Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under

this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract.

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

**2. EEO Officer:** The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

**3. Dissemination of Policy:** All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

**4. Recruitment:** When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

**5. Personnel Actions:** Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

**6. Training and Promotion:**

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are

applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

**7. Unions:** If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

**8. Reasonable Accommodation for Applicants / Employees with Disabilities:** The contractor must be familiar

with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established there under. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

**9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment:** The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

**10. Assurance Required by 49 CFR 26.13(b):**

a. The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.

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

**11. Records and Reports:** The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women;

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on [Form FHWA-1391](#). The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor

will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

### III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more.

The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

### IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding \$2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size). The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 "Contract provisions and related matters" with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

#### 1. Minimum wages

a. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions

of paragraph 1.d. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b.(1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(3) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. The Wage and Hour Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or

will notify the contracting officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

c. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

d. If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program. Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

## 2. Withholding

The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract, or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the contracting agency may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

## 3. Payrolls and basic records

a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-

Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b.(1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency..

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(2) of this section.

(4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the FHWA may, after written notice to the contractor, the contracting agency or the State DOT, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

#### 4. Apprentices and trainees

##### a. Apprentices (programs of the USDOL).

Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly

rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

##### b. Trainees (programs of the USDOL).

Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration.

The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

d. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

**5. Compliance with Copeland Act requirements.** The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

**6. Subcontracts.** The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

**7. Contract termination; debarment.** A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

**8. Compliance with Davis-Bacon and Related Act requirements.** All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

**9. Disputes concerning labor standards.** Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

**10. Certification of eligibility.**

a. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

**V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT**

The following clauses apply to any Federal-aid construction contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

**1. Overtime requirements.** No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

**2. Violation; liability for unpaid wages; liquidated damages.** In the event of any violation of the clause set forth in paragraph (1.) of this section, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1.) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1.) of this section.

**3. Withholding for unpaid wages and liquidated damages.** The FHWA or the contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2.) of this section.

**4. Subcontracts.** The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

## VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term "perform work with its own organization" refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions:

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;

(2) the prime contractor remains responsible for the quality of the work of the leased employees;

(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and

(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is

evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

## VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C.3704).

## VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

#### **IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT**

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.
2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section X in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

#### **X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION**

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost \$25,000 or more – as defined in 2 CFR Parts 180 and 1200.

##### **1. Instructions for Certification – First Tier Participants:**

- a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.
- b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this

covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

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## **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.

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**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.

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**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.



**Replace "Contract" in the 3rd paragraph of section 8-1.02D(2) with:**

work

10-19-12

**Replace "Contract" in item 9 in the list in the 4th paragraph of section 8-1.02D(4) with:**

work

10-19-12

**Replace "Contract completion" in the 4th paragraph of section 8-1.02D(6) with:**

work completion

10-19-12

**Replace "Contract working days" in the 4th paragraph of section 8-1.02D(6) with:**

original working days

10-19-12

**Delete items 1.3 and 1.4 in the list in the 1st paragraph of section 8-1.02D(10).**

04-20-12

**Replace the last paragraph of section 8-1.04B with:**

The Department does not adjust time for work performed before Contract approval.

10-30-15

**Replace the 1st paragraph of section 8-1.05 with:**

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

10-30-15

**Replace the 2nd paragraph of section 8-1.05 with:**

Complete the work within the Contract time.

10-19-12

**Delete "unless the Contract is suspended for reasons unrelated to your performance" in the 4th paragraph of section 8-1.05.**

10-19-12

**Replace the headings and paragraphs in section 8-1.06 with:**

The Engineer may suspend work wholly or in part due to conditions unsuitable for work progress. Provide for public safety and a smooth and unobstructed passageway through the work zone during the suspension as specified under sections 7-1.03 and 7-1.04. Providing the passageway is force account work. The Department makes a time adjustment for the suspension due to a critical delay.

10-19-12



**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

**Delete ", Huntington Beach," in the 3rd paragraph of section 9-1.07A.**

04-20-12

**Replace the formula in section 9-1.07B(2) with:**

04-20-12

$$Qh = HMATT \times Xa$$

**Replace "weight of dry aggregate" in the definition of the variable  $X_a$  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

$$Q_{rh} = RHMATT \times 0.80 \times X_{arb}$$

**Replace "weight of dry aggregate" in the definition of the variable  $X_{arb}$  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

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

**Replace "weight of dry aggregate" in the definition of the variable  $X_{mab}$  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

$$Q_{rap} = HMATT \times X_{aa}$$

**Replace "weight of dry aggregate" in the definitions of the variables  $X_{aa}$  and  $X_{ta}$  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):**

except as specified in section 9-1.16E(3)

10-30-15

**Delete "revised Contract" in item 1 of the 1st paragraph of section 9-1.16E(2).**

10-19-12

**Add to the end of the 1st sentence of the 1st paragraph of section 9-1.16E(3):**

except as specified below for the failure to submit a document during the last estimate period

10-30-15

**Add to the end of section 9-1.16E(3):**

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.

10-30-15

**Replace the 1st paragraph of section 9-1.16E(4) with:**

The Department withholds payments to cover claims filed under Civ Code § 9000 et seq.

10-30-15

**Replace "2014" in the 1st paragraph of section 9-1.16F with:**

2020

10-19-12

**Replace the 2nd paragraph of section 9-1.17C with:**

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.

10-19-12

**Add between "the" and "final estimate" in the 1st sentence in the 3rd paragraph of section 9-1.17C:**

proposed

10-19-12





**Replace the 3rd paragraph of section 11-3.01C with:**

07-19-13

For each inspection, including fit-up, WPS verification, and final weld inspection, the QC Inspector must confirm and document compliance with the specifications, AWS welding codes, and any referenced drawings.

**Replace the paragraphs in section 11-3.01D with:**

07-19-13

The Engineer has the authority to verify the qualifications or certifications of any welder, QC Inspector, or NDT personnel to specified levels by retests or other means determined by the Engineer. If welding will be performed without gas shielding, then qualification must also include welding without gas shielding.

Replace clause 6.14.6.1 of AWS D1.1, clause 7.8 of AWS D1.4, and clause 6.1.3.4 of AWS D1.5 with:

Personnel performing NDT must be qualified and certified under American Society for Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A and the written practice of the NDT firm. The written practice of the NDT firm must comply with or exceed the guidelines of the ASNT Recommended Practice No. SNT-TC-1A. Individuals who perform NDT, review the results, and prepare the written reports must be one of the following:

1. Certified NDT Level II technicians
2. Level III technicians certified to perform the work of Level II technicians

**Replace the heading and the 1st through 3rd paragraphs of section 11-3.01E with:**

07-19-13

**11-3.01E Weld Joint Details**

If weld joint details proposed for use in the work are not prequalified under clause 3 of AWS D1.1 or figure 2.4 or 2.5 of AWS D1.5, submit the proposed WPS and the intended weld joint locations.

Upon authorization of the proposed joint detail locations and qualification of the proposed joint details, welders and welding operators using these details must weld an additional qualification test plate using the WPS variables and the weld joint detail to be used in production. The test plate must:

1. Have the maximum thickness to be used in production and a minimum length of 18 inches.
2. Be mechanically and radiographically tested. Mechanical and radiographic testing and acceptance criteria must comply with the applicable AWS codes.

If a nonprequalified weld joint configuration is proposed using a combination of WPSs for work welded under AWS D1.1, you may conduct a single test combining the WPSs to be used in production, if the essential variables, including weld bead placement, of each process are limited to those established in table 4.5 of AWS D1.1.

**Replace the 1st paragraph of section 11-3.01F with:**

07-19-13

Replace paragraph 3 of clause 6.26.3.2 of AWS D1.5 with:

3. If indications that exhibit these planar characteristics are present at scanning sensitivity, or other evidence exists to suggest the presence of transverse cracks, a more detailed evaluation of the discontinuity by other means must be performed (e.g., alternate UT techniques, RT, grinding, or gouging for visual inspection or MT of the excavated areas.). For welds that have transverse cracks, excavate the full length of the crack plus 2 inches of weld metal on each side adjacent to the crack and reweld.

**Replace "section" in the 2nd paragraph of section 11-3.01F with:**

07-19-13

clause

**Replace the 1st paragraph of section 11-3.02A with:**

07-19-13

Except for stud welding, section 11-3.02 applies to (1) work welded under sections 49, 52, 55, and 75-1.03E and (2) work in section 99 that must comply with an AWS welding code.

**Replace the 4th through 6th paragraphs of section 11-3.02C(2) with:**

07-19-13

Submit an amended welding QC plan or an addendum to the welding QC plan for any changes to:

1. WPSs
2. NDT firms
3. QC personnel or procedures
4. NDT personnel or procedures
5. Systems for tracking and identifying welds
6. Welding personnel

Allow 15 days for the Engineer's review of an amended welding QC plan or an addendum to the welding QC plan.

Submit 7 copies of each authorized QC plan and any authorized addendums. Make 1 copy available at each location where work is performed.

**Replace the 1st paragraph of section 11-3.02C(3) with:**

07-19-13

Submit a welding report within 7 days following the performance of any welding. The welding report must include:

1. Daily production log for welding for each day that welding is performed
2. Reports of all visual weld inspections and NDT performed, whether specified, additional, or informational
3. Radiographs and radiographic reports, and other required NDT reports
4. Summary of welding and NDT activities that occurred during the reporting period
5. Reports of each application of heat straightening
6. Summarized log listing the rejected lengths of weld by welder, position, process, joint configuration, and piece number
7. Documentation that you have:
  - 7.1. Evaluated all radiographs and radiograph reports and NDT and NDT reports
  - 7.2. Corrected all rejectable deficiencies and that all repaired welds have been reexamined using the required NDT and found acceptable
8. Reports or chart recordings of each application of any stress relieving used
9. Reports and chart recordings for any electroslag welding used

**Add between "radiographic" and "envelopes" in the introductory clause in the 3rd paragraph of section 11-3.02C(3):**

07-19-13

film

**Delete the 3rd sentence in the 5th paragraph of section 11-3.02C(3).**

**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



**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.

01-15-16

#### **12-4.03D Closure Status**

Update the status of authorized closures using the LCS Mobile web page.

For a stationary closure, use code:

1. 10-97 immediately before you place the 1st advance warning sign
2. 10-98 immediately after you remove all of the advance warning signs

For a moving closure, use code:

1. 10-97 immediately before the actual start time of the closure
2. 10-98 immediately after the actual end time of the closure

Cancel an authorized closure by using code 10-22 within 2 hours after the authorized start time.

If you are unable to access the LCS Mobile web page, immediately notify the Engineer of the closure's status.

#### **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.



**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.

**Delete "and NELs are violated" in the 3rd paragraph of section 13-3.03C.**

04-19-13

**Replace "working days" at each occurrence in section 13-3.04 with.**

original working days

10-19-12

**Delete the 1st sentence in the 2nd paragraph of section 13-4.03C(3).**

04-19-13

**Add between the 2nd and 3rd paragraphs of section 13-4.03C(3):**

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

04-19-13

**Delete the 7th paragraph of section 13-4.03C(3).**

05-30-14

**Replace the heading of section 13-4.03E(1) with:**

**General**

05-30-14

**Delete the 1st through 5th sentences in the 2nd paragraph of section 13-4.03E(1).**

05-30-14

**Replace the 1st sentence of the 1st paragraph of section 13-4.03E(3) with:**

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.

05-30-14

	<b>Replace the paragraph in section 13-4.04 with:</b>	04-20-12
Not Used		
	<b>Replace "20-7.02D(6)" in section 13-5.02C with:</b>	07-19-13
20-5.03E		
	<b>Delete "or stockpile" in the 3rd paragraph of section 13-5.02F.</b>	10-19-12
	<b>Replace "20-7.03I(10)" in section 13-5.03C with:</b>	07-19-13
20-5.03E(3)		
	<b>Replace section 13-5.03F with:</b>	04-20-12
13-5.03F Reserved		
	<b>Delete "or stockpile" in item 1 in the list in the 1st paragraph of section 13-5.03K.</b>	10-19-12
	<b>Delete the 3rd paragraph of section 13-5.03K.</b>	10-19-12
	<b>Replace the 2nd sentence in the 1st paragraph of section 13-9.01A with:</b>	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		
	<b>Replace the 2nd paragraph of section 13-9.01B with:</b>	10-19-12
Retain and submit an informational submittal for records of disposed concrete waste.		
	<b>Delete the 4th paragraph of section 13-9.01B.</b>	10-19-12
	<b>Delete "if authorized" in the 1st sentence in the 1st paragraph of section 13-9.02A.</b>	10-19-12



**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

**Delete "using Department-furnished tags" in the 4th paragraph of section 15-2.03A(2)(a).**

10-30-15

**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:**

Not Used

07-19-13

**Delete the 5th paragraph of section 15-3.03.**

07-19-13

**Replace the paragraphs of section 15-3.04 with:**

Not Used

10-30-15

**Add to the end of section 15-4.01A(2):**

Allow 20 days for review of the bridge removal work plan.

04-19-13

**Replace the 2nd sentence of the 3rd paragraph of section 15-4.02C(1) with:**

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).

10-17-14

**Replace the 1st paragraph of section 15-5.01C(1) with:**

Before starting deck rehabilitation activities, complete the removal of any traffic stripes, pavement markings, and pavement markers.

10-19-12

**Replace the 2nd and 3rd paragraphs of section 15-5.01C(2) with:**

Perform the following activities in the order listed:

10-19-12

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:**

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.

10-19-12

**Delete "and concrete expansion dams" in the 3rd paragraph of section 15-5.01C(4).**

04-19-13

**Replace the 2nd paragraph of section 15-5.03A(2) with:**

For a contract with less than 60 original working days, submit certificates of compliance for the filler material and bonding agents.

10-19-12

**Replace "51-1.02C" in the 1st paragraph of section 15-5.03B with:**

51-1.02F

04-19-13

**Replace the 4th paragraph of section 15-5.03B with:**

For a contract with less than 60 original working days, alternative materials must be authorized before use.

10-19-12

**Add between the 5th and 6th paragraphs of section 15-5.03C:**

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.**

10-19-12

**Replace "51-1.03F(5)" in the 3rd paragraph of section 15-5.06C(1) with:**

51-1.01D(4)(b)

07-19-13

**Replace "51-1.03E(5)" in the 5th paragraph of section 15-5.06C(1) with:**

51-1.03F(5)

10-19-12

**Delete the 9th paragraph of section 15-5.06C(1).**

10-19-12

**Delete the 15th paragraph of section 15-5.06C(1).**

04-19-13

**Add between the 18th and 19th paragraphs of section 15-5.06C(1):**

Texture the polyester concrete surface before gelling occurs by longitudinal tining under 51-1.03F(5)(b)(iii), except do not perform initial texturing.

07-19-13

**Replace section 15-5.06C(2) with:**

**15-5.06C(2) Reserved**

04-19-13

**Delete the 3rd paragraph of section 15-5.06D.**

04-19-13

**Replace the 1st paragraph in section 15-5.07B(4) with:**

Payment for furnishing dowels is not included in the payment for core and pressure grout dowel.

10-19-12

**Replace section 15-5.09 with:**

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):**

Within 5 days of completing annular space grouting at a culvert, submit the grouting records.

07-19-13



AA

## 18 DUST PALLIATIVE

10-30-15

Replace section 18 with:

10-30-15

## 18 DUST PALLIATIVES

### 18-1.01 GENERAL

#### 18-1.01A Summary

Section 18 includes specifications for applying dust palliatives.

A dust palliative must be any of the following:

1. Water
2. Dust suppressant
3. Dust control binder

Water must comply with section 17.

#### 18-1.01B Definitions

Reserved

#### 18-1.01C Submittals

If a dust suppressant or dust control binder is to be used, submit a dust treatment plan at least 15 days before starting job site activities. The dust treatment plan must include:

1. Product name and type
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 <sup>a</sup> (LC50 min, ppm)	ASTM E729 or EPA Method 600/4-90/027F and EPA Method 600/4-91/002	10
Aquatic toxicity <sup>a</sup> (rating)	ASTM E729 or EPA Method 600/4-90/027F and EPA Method 600/4-91/002	slightly toxic or better
Renewal toxicity <sup>b</sup> (LC50 min, ppm)	ASTM E1295	10
Renewal toxicity <sup>b</sup> (rating)	ASTM E1295	slightly toxic or better

<sup>a</sup>Using *Ceriodaphnia dubia* (water flea), *Oncorhynchus mykiss* (rainbow trout), *Pimephales promelas* (fathead minnow), and *Americamysis bahia* (mysid shrimp)

<sup>b</sup>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 <sup>a</sup> )	ASTM D2170	188
Flash point (min °C)	ASTM D92	205
Particle charge test	ASTM D7402	Positive

<sup>a</sup>Use ASTM D2161 to convert the mm<sup>2</sup>/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<sup>a</sup> 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

<sup>a</sup>ASTM D98 or AASHTO M144

Calcium chloride flake must comply with the requirements shown in the following table:

### Calcium Chloride Flake<sup>a</sup> Requirements

Quality characteristic	Test method	Requirement
Calcium chloride content (min, %)	ASTM E449	75
Total magnesium as MgCl <sub>2</sub> (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	100
3/8–inch sieve		80–100
No. 4 sieve		0–5
No. 30 sieve		

<sup>a</sup>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 <sup>a</sup>	28–33
Sulfate content as magnesium sulfate (max, %)	ASTM D4691 <sup>a</sup>	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

<sup>a</sup>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:

<b>Dust Suppressant Application</b>		
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 <sup>a</sup>	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

<sup>a</sup>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:**

20-2.02C(2)

07-19-13

**Replace the 3rd paragraph in section 19-2.01A with:**

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.**

07-19-13

**Add to the 2nd paragraph of section 19-2.03D:**

Topsoil must comply with section 21.

10-17-14

**Replace the 2nd paragraph of section 19-3.01A(2)(b) with:**

For cofferdams on or affecting railroad property, allow 85 days for review.

07-01-11

**Add to the list in the 1st paragraph of section 19-3.01A(2)(d):**

9. Provisions for discontinuous rows of soil nails

01-20-12

**Replace "sets" in the 3rd and 4th paragraphs of section 19-3.01A(2)(d) with:**

copies

04-19-13

**Add to section 19-3.01A(3)(b):**

For soil nail walls, wall zones are specified in the special provisions.

01-20-12

For ground anchor walls, a wall zone is the entire wall unless otherwise specified in the special provisions.

**Delete the 2nd sentence in the 4th paragraph of section 19-3.01A(3)(b).**

01-20-12

**Replace "90" in the paragraph of section 19-3.02G with:**

90-1

01-18-13

**Add to section 19-3.02:**

**19-3.02I Filter Fabric**

Filter fabric must be Class A.

07-19-13

**Replace the heading of section 19-3.03C with:**

**19-3.03B(4) Cofferdams**

04-19-13

**Replace the heading of section 19-3.03D with:**

**19-3.03B(5) Water Control and Foundation Treatment**

04-19-13

**Replace the 1st paragraph of section 19-3.03E(3) with:**

Compact structure backfill behind lagging of soldier pile walls by hand tamping, mechanical compaction, or other authorized means.

01-20-12

**Add to the end of section 19-3.03E(3):**

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.
3. Grout and shotcrete have cured for at least 72 hours.
4. Specified tests are complete for that portion of wall and the results are authorized.
5. Soil nail facing anchorages are attached or ground anchors are locked off.

01-18-13

01-20-12



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
6. Rain sensors
7. Remote control valves
8. Backflow preventers

10-30-15

07-19-13

###### 20-2.01A(3)(c) Maintenance and Operation Manuals

Before Contract acceptance, submit as an informational submittal a manufacturer's maintenance and operation manual for each type of controller installed.

##### 20-2.01A(4) Quality Control and Assurance

###### 20-2.01A(4)(a) General

Reserved

## **20-2.01A(4)(b) Pressure Testing**

### **20-2.01A(4)(b)(i) General**

Perform pressure testing for leakage on irrigation supply lines:

1. In the Engineer's presence
2. On business days between 8 a.m. and 5 p.m. unless authorized
3. Before backfilling supply line trenches
4. With irrigation system gate valves open
5. With open ends of the supply line and fittings plugged or capped

Notify the Engineer at least 48 hours before performing a pressure test.

Choose either Method A or B to test supply lines installed by trenching and backfilling and supply lines that are completely visible after installation.

All other supply lines, including those installed in the ground by methods other than trenching and backfilling must be tested by Method A.

Test irrigation supply line in conduit by Method A with the testing period modified to 0.5 hour and no allowable pressure drop.

### **20-2.01A(4)(b)(ii) Method A**

Method A pressure testing procedures for leakage must comply with the following:

1. Pressure gauge must be calibrated from 0 to 200 psi in 5 psi increments and be accurate to within a tolerance of 2 psi.
2. Supply line must be filled with water and connected to a pressure gauge. Place the pipeline under a pressure of 125 psi. Remove the source of pressure and leave the line under the required pressure.
3. Test the supply line under the required pressure for a period of 1 hour. The pressure gauge must remain in place until each test period is complete.
4. Leaks that develop in the tested portion of the system must be located and repaired after each test period if a drop of more than 5 psi is indicated by the pressure gauge. After the leaks have been repaired, repeat the 1 hour pressure test until the drop in pressure is 5 psi or less.

If a system consists of a new supply line connected to an existing line, the new supply line must be isolated from the existing line and tested.

### **20-2.01A(4)(b)(iii) Method B**

Method B pressure testing procedures for leakage must comply with the following:

1. Before any portion of the supply line on the upstream side of a control valve is backfilled, water must be turned on for that portion of the line and maintained at full pressure from the water source for a period not less than 8 consecutive hours after all air has been expelled from the line. Before any portion of the supply line on the downstream side of the control valve is backfilled, perform the same test for a period not less than 1 hour.
2. Repair leaks that develop in the tested portion of the system. After the leaks have been repaired, repeat the pressure test until no leaks occur as determined by the Engineer.

### **20-2.01A(4)(c) Sprinkler Coverage Check**

After installation of the sprinklers, check and adjust the entire sprinkler system for proper orientation and uniform coverage.

### **20-2.01A(4)(d) Irrigation System Functional Tests**

The functional tests for each irrigation controller or group of controllers and associated irrigation system served by a single electric service point must consist of at least 1 complete cycle of operation. The Engineer determines the length of the cycle.

Notify the Engineer at least 10 days before performing each functional test.

### **20-2.01A(4)(e) Final Irrigation System Check**

Perform the final check of the existing and new irrigation system between 20 and 30 days before Contract acceptance. The Engineer determines the length of the cycle.

Remote control valves connected to existing and new irrigation controllers must be checked for automatic operation when the controllers are in automatic mode.

### **20-2.01B Materials**

#### **20-2.01B(1) General**

Use minor concrete for replacing removed concrete facilities.

HMA for replacing removed asphalt concrete surfacing and facilities must comply with section 39. You may use minor HMA if authorized.

#### **20-2.01B(2) Garden Valves**

Each garden valve must:

1. Be inverted nose type and of brass or bronze construction with female thread inlet
2. Have a replaceable seat washer, rising valve stem within a protective collar, and male thread hose outlet
3. Have a loose key handle

#### **20-2.01B(3) Recycled Water Identification**

Irrigation components used for recycled water must be manufactured or painted purple. Recycled water irrigation pipe and tubing must have a permanent label with the wording "CAUTION RECYCLED WATER" every 24 inches in 2 rows spaced approximately 180 degrees apart in the longitudinal direction of the pipe or tubing.

The recycled water warning sign must be a decal or a decal attached to a 1/16-inch thick aluminum plate or tag.

Each warning sign decal must:

1. Show the phrase "Recycled Water, Do Not Drink" and the drinking glass graphic symbol
2. Be UV fade and weather resistant and manufactured from flexible vinyl with or without mylar
3. Have a purple background, black text, and self-adhesive backing

Each warning tag must:

1. Show the phrase "RECYCLED WATER" and the drinking glass graphic symbol
2. Be UV fade and weather resistant
3. Be purple, double-sided, and manufactured from polyurethane
4. Have an integral neck attachment and attachment hole capable of withstanding 178 lb of pull-out resistance
5. Have hot-stamped black lettering

Posts and hardware for warning signs must comply with section 56-4.

Concrete sprinkler protectors used with recycled water must be painted purple.

#### **20-2.01B(4) Location Markers**

Location markers must be schedule 40 white PVC plastic pipe.

#### **20-2.01B(5) Pull Boxes**

Pull boxes must comply with section 86-2.06 and be no. 5 or larger unless otherwise shown. Pull boxes for low voltage conductors must not have side openings.

10-30-15

Pull box covers used solely for irrigation electrical service must be marked "IRRIGATION".

07-19-13

**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. 07-19-13
- 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.

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. 11-15-13

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.

Trenches must be at least 4 feet from curbs, dikes, and paved shoulders. 07-19-13

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.

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. 11-15-13

### **20-2.01C(3) Pull Boxes**

Install pull boxes under section 86-2.06 at the following locations: 07-19-13

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.

01-15-16

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 56-4.

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.

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#### **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

**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**

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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**

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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**

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

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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**

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. 10-30-15

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. 07-19-13

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 <sup>a</sup>	--
O	Acorn	--
P	Plugs <sup>a, b</sup>	--
S	Seedling <sup>c</sup>	--
U	No. 15 container	2768–3696

<sup>a</sup>Do not use containers made of biodegradable material.

<sup>b</sup>Grown in individual container cells.

<sup>c</sup>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  $5/8 \pm 1/4$  inch, not including top growth and thatch

Protect sod with tarps or other protective covers during delivery. Do not allow sod to dry out during delivery or before placement.

### **20-3.01B(3) Soil Amendment**

Soil amendment must comply with the requirements in the Food & Agri Code. Soil amendment must be one or a combination of the following:

1. Sphagnum peat moss
2. Nitrolized fir bark
3. Vermiculite
4. Perlite

### **20-3.01B(4) Fertilizers**

#### **20-3.01B(4)(a) General**

Deliver fertilizer in labeled containers showing weight, chemical analysis, and manufacturer's name.

Fertilizer must comply with the requirements of the Food & Agri Code.

#### **20-3.01B(4)(b) Slow-release Fertilizers**

Slow-release fertilizer must be a pelleted or granular form with a nutrient release over an 8 to 12 month period and must comply with the chemical analysis ranges shown in the following table:

Ingredient	Content (percent)
Nitrogen (N)	16–21
Phosphoric acid (P)	6–8
Water soluble potash (K)	4–10

**20-3.01B(4)(c) Packet Fertilizers**

Packet fertilizer must be a biodegradable packet with a nutrient release over a 12 month period. Each packet must have a weight of 10 ± 1 grams and must comply with the chemical analysis shown in the following table:

Ingredient	Content (percent)
Nitrogen(N)	20
Phosphoric acid (P)	10
Water soluble potash (K)	5

**20-3.01B(4)(d) Organic Fertilizers**

Organic fertilizer must be pelleted or granular with a cumulative nitrogen release rate of no more than 70 percent for the first 70 days after incubation at 86 degrees F with 100 percent at 350 days or more. Organic fertilizer must comply with the chemical analysis shown in the following table:

Ingredient	Content (percent)
Nitrogen (N)	5–7
Phosphoric acid (P)	1–5
Water soluble potash (K)	1–10

**20-3.01B(5) Root Stimulants**

Root stimulant must be a commercial quality product.

**20-3.01B(6) Plaster Sand**

Backfill material for the palm tree planting holes must be 100 percent commercial quality washed plaster sand. 10-30-15

**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. 07-19-13

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 such that at least 95 percent of the material by volume is less than 2 inches in any direction and no more than 30 percent by volume is less than 1 inch in any direction.

01-15-16

##### **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



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
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**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**



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) <sup>b</sup>	ASTM C 231		4
Penetration (inches)	ASTM C 360		0 to 1-1/2 nominal <sup>c, d</sup>
Slump (inches)	ASTM C 143		0-3 nominal <sup>c, d</sup>
Compressive strength (min, psi at 7 days)	ASTM C 39 <sup>e</sup>		530
Compressive strength (max, psi at 3 days) <sup>f</sup>	ASTM C 39 <sup>e</sup>		500

<sup>a</sup> Comply with the table titled "Aggregate Grading" in section 28-2.02C.

<sup>b</sup> If no single test in the first 5 air content tests exceeds 1-1/2 percent, no further air content tests are required.

<sup>c</sup> Maximum penetration must not exceed 2 inches and maximum slump must not exceed 4 inches

<sup>d</sup> Test for either penetration or slump

<sup>e</sup> Prepare cylinders under ASTM C 31

<sup>f</sup> 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 <sup>a</sup>	530 <sup>b</sup>

<sup>a</sup> Cylinders prepared under ASTM C 31

<sup>b</sup> A compressive strength test represents up to (1) 1,000 cu yd or (2) 1 day's production if less than 1,000 cu yd.

## 28-2.02 MATERIALS

### 28-2.02A General

Water must comply with section 90-1.02D.

The air content in LCB must not exceed 4 percent. If the aggregate used for LCB is produced from processed reclaimed asphalt concrete or other material that may cause the air content to exceed 4 percent, reduce the air content with an admixture.

A water-reducing chemical admixture may be used. Water-reducing chemical admixture must comply with ASTM C 494, Type A or Type F.

Air-entraining admixtures must comply with section 90-1.02E.

### 28-2.02B Cementitious Material

Portland cement must comply with section 90-1.02B. Portland cement content must not exceed 300 lb/cu yd.

SCM must comply with section 90-1.02B except the equations for SCM content under 90-1.02B(3) do not apply.

For aggregate qualification testing, use Type II portland cement under section 90-1.02B(2) without SCM.

### 28-2.02C Aggregate

Aggregate must be clean and free from decomposed material, organic material, and other deleterious substances. Aggregate samples must not be treated with lime, cement, or chemicals before testing for sand equivalent.

Use either 1-1/2 inch or 1 inch grading. Do not change your selected aggregate grading without authorization.

When tested under ASTM C 136, the percentage composition by weight of the aggregate must comply with the grading requirements for the sieve sizes shown in the following table:

Sieve sizes	Aggregate Grading			
	Percentage passing			
	1-1/2" maximum		1" maximum	
	Operating range	Contract compliance	Operating range	Contract compliance
2"	100	100	--	--
1-1/2"	90-100	87-100	100	100
1"	--	--	90-100	87-100
3/4"	50-85	45-90	50-100	45-100
3/8"	40-75	35-80	40-75	35-80
No. 4	25-60	20-65	35-60	30-65
No. 30	10-30	6-34	10-30	6-34
No. 200	0-12	0-15	0-12	0-15

Aggregate must comply with the quality requirements shown in the following table:

Aggregate Quality			
Property	Test Method	Operating range	Contract compliance
Sand equivalent (min)	ASTM D 2419	21	18
Compressive strength (min, psi at 7 days)	ASTM C 192 ASTM C 39	--	610 at 300 lb/cu yd cement content

Note: Cement must be Type II portland cement under section 90-1.02B(2).

If the aggregate grading or the sand equivalent test results, or both comply with contract compliance requirements but not operating range requirements, you may continue placing LCB for the remainder of

the work day. Do not place additional LCB until you demonstrate the LCB to be placed complies with the operating range requirements.

### **28-2.03 CONSTRUCTION**

#### **28-2.03A General**

Do not allow traffic or equipment on the LCB for at least 72 hours after the 1st application of the curing compound and completion of contraction joints. Limit traffic and equipment on the LCB to that is required for placing additional layers of LCB or paving.

#### **28-2.03B Subgrade**

Immediately before spreading LCB, the subgrade must:

1. Comply with the specified compaction and elevation tolerance for the material involved
2. Be free from loose or extraneous material
3. Be uniformly moist

Areas of subgrade lower than the grade established by the Engineer must be filled with LCB. The Department does not pay for filling low areas of subgrade.

#### **28-2.03C Proportioning, Mixing, and Transporting**

Proportion LCB under section 90-1.02F except aggregate does not have to be separated into sizes.

Mix and transport LCB under section 90-1.02G except the 5th and 7th paragraphs in section 90-1.02G(6) do not apply.

#### **28-2.03D Placing**

Place LCB under section 40-1.03H(1) except the 3rd paragraph does not apply.

Unless otherwise described, construct LCB in minimum widths of 12 feet separated by construction joints. For LCB constructed monolithically in widths greater than 26 feet, construct a longitudinal contraction joint offset no more than 3 feet from the centerline of the width being constructed.

Contraction joints must comply with section 40-1.03D(3).

Construct transverse contraction joints in intervals that result in LCB areas where the lengths and widths are within 20 percent of each other. Measure the widths from any longitudinal construction or longitudinal contraction joints.

The Engineer waives the requirement for transverse contraction joints if you:

1. Submitted a notice under 28-2.01C(1)
2. Successfully field qualified LCB for 3-day compressive strength testing
3. Submit QC test results for 3-day compressive strength under section 28-2.01D(4).

If concrete pavement will be placed on LCB, construct longitudinal construction and longitudinal contraction joints in the LCB. Provide at least 1 foot horizontal clearance from planned longitudinal construction and longitudinal contraction joints in the concrete pavement.

Do not mix or place LCB when the atmospheric temperature is below 35 degrees F. Do not place LCB on frozen ground.

#### **28-2.03E Finishing**

Place LCB under section 40-1.03H(4) or under section 40-1.03H(5) except where there are confined work areas and when authorized:

1. Spread and shape LCB using suitable powered finishing machines and supplement with hand work as necessary
2. Consolidate LCB using high-frequency internal vibrators within 15 minutes after LCB is deposited on the subgrade
3. Vibrate with care such that adequate consolidation occurs across the full paving width and do not use vibrators for extensive weight shifting of the LCB

For LCB to be paved with HMA, before curing operation texture the LCB finished surface by dragging a broom, burlap, or a spring steel tine device. If using a spring steel tine device, the device must produce a scored surface with scores parallel or transverse to the pavement centerline. Texture at a time and in a manner that produces the coarsest texture for the method used.

For LCB to be paved with HMA, the finished surface must not vary more than 0.05 foot from the grade established by the Engineer.

Do not texture LCB that will be covered with concrete pavement. Before applying curing compound, finish LCB to a smooth surface free from mortar ridges and other projections.

For LCB to be paved with concrete pavement, the finished surface must not be above the grade, or more than 0.05 foot below the grade established by the Engineer.

The finished surface must be free from porous areas.

#### **28-2.03F Curing**

After finishing LCB, cure LCB with pigmented curing compound under section 90-1.03B(3) and 40-1.03K except for LCB to be paved with concrete pavement, comply with section 36-2. Apply curing compound to the area to be paved with concrete pavement:

1. In 2 separate applications
2. Before the atmospheric temperature falls below 40 degrees F
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:**

#### **28-3 RAPID STRENGTH CONCRETE BASE**

07-19-13

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:

<b>Seal Coat Screenings</b>		
Properties	Test method	Specification
Los Angeles Rattler, %, max	California Test	
Loss at 100 revolutions.	211	10
Loss at 500 revolutions.		40
Film stripping, %, max	California Test	25
	302	

**37-2.01C Construction**

**37-2.01C(1) General**

Wherever final sweeping or brooming of the seal coat surface is complete, place permanent traffic stripes and pavement markings within 10 days.

If you fail to place the permanent traffic stripes and pavement markings within the specified time, the Department withholds 50 percent of the estimated value of the seal coat work completed that has not received permanent traffic stripes and pavement markings.

**37-2.01C(2) Equipment**

Equipment for seal coats must include and comply with the following:

1. Screenings haul trucks. Haul trucks must have:
  - 1.1. Tailgates that discharge screenings
  - 1.2. Devices to lock onto the rear screenings spreader hitch
  - 1.3. Dump beds that will not push down on the spreader when fully raised
  - 1.4. Dump beds that will not spill screenings on the roadway when transferred to the spreader hopper
  - 1.5. Tarpaulins to cover precoated screenings when haul distance exceeds 30 minutes or ambient temperature is less than 65 degrees F
2. Self-propelled screenings spreader. The spreader must have:
  - 2.1. Screenings hopper in the rear
  - 2.2. Belt conveyors that carry the screenings to the front
  - 2.3. Spreading hopper capable of providing a uniform screening spread rate over the entire width of the traffic lane in 1 application.
3. Self-propelled power brooms. Do not use gutter brooms or steel-tined brooms. Brooms must be capable of removing loose screenings adjacent to barriers that prevent screenings from being swept off the roadway, including curbs, gutters, dikes, berms, and railings.
4. Pneumatic-tired rollers. Pneumatic-tired rollers must be an oscillating type at least 4 feet wide. Each roller must be self-propelled and reversible. Pneumatic tires must be of equal size, diameter, type, and ply. The roller must carry at least 3,000 lb of load on each wheel and each tire must have an air pressure of 100 ± 5 psi.

### **37-2.01C(3) Surface Preparation**

Before applying seal coat, cover manholes, valve and monument covers, grates, or other exposed facilities located within the area of application, using a plastic or oil resistant construction paper secured by tape or adhesive to the facility being covered. Reference the covered facilities with a sufficient number of control points to relocate the facilities after the application of the seal coat.

After completion of the seal coat operation, remove covers from the facilities.

Immediately before applying seal coat, clean the surface to receive seal coat by removing extraneous material and drying. Cleaning the existing pavement includes the use of brooms.

### **37-2.01C(4) Applying Emulsion and Asphalt Binder**

Prevent spray on existing pavement not intended for seal coat or on previously applied seal coat using a material such as building paper. Remove the material after use.

Align longitudinal joints between seal coat applications with designated traffic lanes.

For emulsion, overlap longitudinal joints by not more than 4 inches. You may overlap longitudinal joints up to 8 inches if authorized.

For areas not accessible to a truck distributor bar, apply the emulsion with a squeegee or other authorized means. For asphalt binder, hand spray nonaccessible areas. You may overlap the emulsion or asphalt binder applications before the application of screenings at longitudinal joints.

Do not apply the emulsion or asphalt binder unless there are sufficient screenings at the job site to cover the emulsion or asphalt binder.

Discontinue application of emulsion or asphalt binder early enough to comply with lane closure specifications and darkness. Apply to 1 lane at a time and cover the lane entirely in 1 operation.

### **37-2.01C(5) Spreading Screenings**

Prevent vehicles from driving on asphaltic emulsion or asphalt binder before spreading screenings.

Spread screenings at a uniform rate over the full lane width in 1 application.

Broom excess screenings at joints before spreading adjacent screenings.

Operate the spreader at speeds slow enough to prevent screenings from rolling over after dropping.

If the spreader is not moving, screenings must not drop. If you stop spreading and screenings drop, remove the excess screenings before resuming activities.

### **37-2.01C(6) Finishing**

Remove piles, ridges, or unevenly distributed screenings. Repair permanent ridges, bumps, or depressions in the finished surface. Spread additional screenings and roll if screenings are picked up by rollers or vehicles.

Seal coat joints between adjacent applications of seal coat must be smooth, straight, uniform, and completely covered. Longitudinal joints must be at lane lines and not overlap by more than 4 inches. Blend the adjacent applications by brooming.

A coverage is the number of passes a roller needs to cover the width. A pass is 1 roller movement parallel to the seal coat application in either direction. Overlapping passes are part of the coverage being made and are not part of a subsequent coverage. Do not start a coverage until completing the previous coverage.

Before opening to traffic, finish seal coat in the following sequence:

1. Perform initial rolling consisting of 1 coverage with a pneumatic-tired roller
2. Perform final rolling consisting of 3 coverages with a pneumatic-tired roller
3. Broom excess screenings from the roadway and adjacent abutting areas
4. Apply flush coat if specified

The Engineer may order salvaging of excess screenings.

Dispose of excess screenings the Engineer determines are not salvageable. Dispose of screenings in any of the following ways or locations:

1. Under section 14-10
2. On embankment slopes
3. In authorized areas

Salvaging and stockpiling excess screenings is change order work.

### **37-2.01C(7) Seal Coat Maintenance**

Seals coat surfaces must be maintained for 4 consecutive days from the day screenings are applied. Maintenance must include brooming to maintain a surface free of loose screenings, to distribute screenings over the surface so as to absorb any free asphaltic material, to cover any areas deficient in cover coat material, and to prevent formation of corrugations.

After 4 consecutive days, excess screenings must be removed from the paved areas. Brooming must not displace screenings set in asphaltic material.

The exact time of brooming will be determined by the Engineer. As a minimum, brooming will be required at the following times:

1. On 2-lane 2-way roadways, from 2 to 4 hours after traffic, controlled with pilot cars, has been routed on the seal coat
2. On multilane roadways, from 2 to 4 hours after screenings have been placed
3. In addition to previous brooming, immediately before opening any lane to public traffic, not controlled with pilot cars
4. On the morning following the application of screenings on any lane that has been open to public traffic not controlled with pilot cars and before starting any other activities

For 2-lane 2-way roadways under 1-way traffic control, upon completion of secondary rolling, public traffic must be controlled with pilot cars and routed over the new seal coat for a period of 2 to 4 hours. The Engineer will determine the exact period of time.

Schedule the operations so that seal coat is placed on both lanes of the traveled way each work shift and so that 1-way traffic control is discontinued 1 hour before darkness. At the end of the work shift, the end of the seal coat on both lanes must generally match.

On multilane roadways, initial brooming must begin after the screenings have been in place for a period of 2 to 4 hours. If the initial brooming is not completed during the work shift in which the screenings were placed, the initial brooming must be completed at the beginning of the next work shift.

Public traffic must be controlled with pilot cars and be routed on the new seal coat surface of the lane for a minimum of 2 hours after completion of the initial brooming and before opening the lane to traffic not controlled with pilot cars. When traffic is controlled with pilot cars, a maximum of 1 lane in the direction of travel must be open to public traffic. Once traffic controlled with pilot cars is routed over the seal coat at a particular location, continuous control must be maintained at that location until the seal coat placement and brooming on adjacent lanes to receive seal coat is completed.

### **37-2.01D Payment**

If there is no bid item for a traffic control system, furnishing and using a pilot car is included in the various items of the work involved in applying the seal coat.

If test results for the screenings grading do not comply with specifications, you may remove the seal coat represented by these tests or request that it remain in place with a payment deduction. The deduction is \$1.75 per ton for the screenings represented by the test results.

## **37-2.02 FOG SEAL**

### **37-2.02A General**

#### **37-2.02A(1) Summary**

Fog seal coat includes applying a slow-setting asphaltic emulsion.

#### **37-2.02A(2) Definitions**

Reserved

#### **37-2.02A(3) Submittals**

Submit a 1/2-gallon sample of the asphaltic emulsion in a plastic container. Take the sample from the distributor truck spray bar at mid-load.

#### **37-2.02A(4) Quality Control and Assurance**

Reserved

### **37-2.02B Material**

The Engineer selects the grade of slow-setting asphaltic emulsion to be used.

If additional water is added to the asphaltic emulsion, the resultant mixture must not be more than 1 part asphaltic emulsion to 1 part water. The Engineer determines the exact amount of additional water.

### **37-2.02C Construction**

Apply asphaltic emulsion for fog seal coat at a residual asphalt rate from 0.02 to 0.06 gal/sq yd. The Engineer determines the exact rate.

Apply fog seal coat when the ambient air temperature is above 40 degrees F.

Sprinkle water on fog seal coat that becomes tacky in an amount determined by the Engineer.

If fog seal coat and seal coat with screenings are specified on the same project, apply fog seal coat at least 4 days before applying the adjoining seal coat with screenings. The joint between the seal coats must be neat and uniform.

### **37-2.02D Payment**

The Department does not adjust the unit price for an increase or decrease in the asphaltic emulsion (fog seal coat) quantity.

## **37-2.03 FLUSH COATS**

### **37-2.03A General**

Flush coat includes applying a fog seal coat to the surface, followed by sand.

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### **37-2.03B Material**

The Engineer selects the grade of slow-setting or quick-setting asphaltic emulsion to be used.

Sand for flush coat must comply with the material specifications for fine aggregate grading in section 90-1.02C(3). Sand must not include organic material or clay.

### **37-2.03C Construction**

Apply asphaltic emulsion for flush coat at a residual asphalt rate from 0.02 to 0.06 gal/sq yd. The Engineer determines the exact rate.

During flush coat activities, close adjacent lanes to traffic. Do not track asphaltic emulsion on existing pavement surfaces.

Apply sand immediately after the asphaltic emulsion application.

Spread sand with a self-propelled screenings spreader equipped with a mechanical device that spreads sand at a uniform rate over the full width of a traffic lane in a single application. Spread sand at a rate from 2 to 6 lb/sq yd. The Engineer determines the exact rate.

### **37-2.03D Payment**

The Department does not adjust the unit price for an increase or decrease in the sand cover for the flush coat quantity.

## **37-2.04 ASPHALTIC EMULSION SEAL COAT**

### **37-2.04A General**

#### **37-2.04A(1) General**

##### **37-2.04A(1)(a) Summary**

Section 37-2.04 includes specifications for applying asphaltic emulsion seal coat. Asphaltic emulsion seal coat includes applying asphaltic emulsion, followed by screenings, and then a flush coat.

Asphaltic emulsion seal coat includes one or more of the following types:

1. Nonpolymer asphaltic emulsion seal coat
2. Polymer asphaltic emulsion seal coat

A double asphaltic emulsion seal coat is the application of asphaltic emulsion, followed by screenings applied twice in sequence.

##### **37-2.04A(1)(b) Definitions**

Reserved

##### **37-2.04A(1)(c) Submittals**

At least 10 days before starting asphaltic emulsion seal coat application, submit the name of an authorized laboratory that will be performing asphaltic emulsion QC testing.

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.

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Within 7 days after taking samples, submit the authorized laboratory's test results for asphaltic emulsion.

##### **37-2.04A(1)(d) Quality Control and Assurance**

Samples for the screenings grading and cleanness value must be taken from the spreader conveyor belt.

03-21-14

Within 3 business days of sampling, the authorized laboratory must test the asphaltic emulsion for:

1. Viscosity under AASHTO T 59
2. Sieve test under AASHTO T 59
3. Demulsibility under AASHTO T 59
4. Torsional recovery under California Test 332 for polymer asphaltic emulsion
5. Elastic recovery under AASHTO T 301 for polymer asphaltic emulsion

Circulate asphaltic emulsion in the distributor truck before sampling. Take samples from the distributor truck at mid load or from a sampling tap or thief. Before taking samples, draw and dispose of 1 gallon. In the presence of the Engineer take two 1/2-gallon samples every 55 tons or at least 1 day's production.

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##### **37-2.04A(2) Materials**

Not Used

##### **37-2.04A(3) Construction**

The Engineer determines the exact application rate.

At the time of application, the temperature of the asphaltic emulsion must be from 130 to 180 degrees F.

When tested under California Test 339, the application rate for asphaltic emulsion must not vary from the average by more than:

1. 15 percent in the transverse direction
2. 10 percent in the longitudinal direction

**37-2.04A(4) Payment**

Not Used

**37-2.04B Nonpolymer Asphaltic Emulsion Seal Coat**

**37-2.04B(1) General**

**37-2.04B(1)(a) Summary**

Section 37-2.04B includes specifications for applying a nonpolymer asphaltic emulsion seal coat.

**37-2.04B(1)(b) Definitions**

Reserved

**37-2.04B(1)(c) Submittals**

Reserved

**37-2.04B(1)(d) Quality Control and Assurance**

For nonpolymer asphaltic emulsion seal coat, if a test result for the screenings cleanness value is from 75 to 80, you may request that the asphaltic emulsion seal coat represented by the test remain in place. A payment deduction is made as specified in section 37-2.04D. If the screenings cleanness value is less than 75, remove the asphaltic emulsion seal coat.

**37-2.04B(2) Materials**

Screenings for nonpolymer asphaltic emulsion seal coat must have the gradation as determined under California Test 202 in the following table.

**Nonpolymer Asphaltic Emulsion Seal Coat Screenings  
Gradation**

Sieve sizes	Percentage passing			
	Coarse 1/2" max	Medium 3/8" max	Medium fine 5/16" max	Fine 1/4" max
3/4"	100	--	--	--
1/2"	95-100	100	--	--
3/8"	50-80	90-100	100	100
No. 4	0-15	5-30	30-60	60-85
No. 8	0-5	0-10	0-15	0-25
No. 16	--	0-5	0-5	0-5
No. 30	--	--	0-3	0-3
No. 200	0-2	0-2	0-2	0-2

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The cleanness value determined under California Test 227 must be 80 or greater.

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**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:

<b>Asphaltic Emulsion Application Rates</b>	
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:

<b>Screening Spread Rates</b>	
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:

<b>Screening Spread Rates</b>	
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:

<b>Asphaltic Emulsion Seal Coat Cleanness Value Deductions</b>	
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:

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**Polymer Asphaltic Emulsion Pay Factor Table**

Test method and property	Increment	Pay factor
<b>Test on polymer asphaltic emulsion</b>		
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
<b>Test on residue from evaporation test</b>		
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 <sup>a</sup> )	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 <sup>a</sup> )	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

<sup>a</sup> The highest pay factor applies

The Engineer assesses a pay factor of 1 for sampling not performed in compliance with the specifications, including shipping and sampling containers.

For polymer asphaltic emulsion seal coat, if a test result for the screenings cleanness value is from 75 to 86, you may request that the asphaltic emulsion seal coat represented by the test remain in place. A payment deduction is made as specified in section 37-2.04D. If the screenings cleanness value is less than 75, remove the asphaltic emulsion seal coat.

### 37-2.04C(2) Materials

Polymer asphaltic emulsion must include elastomeric polymer.

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Polymer asphaltic emulsion must comply with section 94, Table 3, under the test on residue from evaporation test for Grades PMRS2, PMRS2h, PMCRS2, and PMCRS2h and the following:

1. The penetration at 39.2 degrees F (200g for 60 seconds) determined under AASHTO T 49 must be at least 6.
2. Elastic recovery determined under AASHTO T 301 must be at least 60 percent.
3. Polymer content in percent by weight does not apply.
4. The ring and ball softening point temperature determined under AASHTO T 53 for Test on Residue from Evaporation Test must comply with the following minimum temperature requirement:
  - 4.1. 126 degrees F for a geographical ambient temperature from 32 to 104 degrees F
  - 4.2. 129 degrees F for a geographical ambient temperature from 18 to 104 degrees F
  - 4.3. 135 degrees F for a geographical ambient temperature from 18 to greater than 104 degrees F

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**

Sieve sizes	Percentage passing			
	Coarse 1/2" max	Medium 3/8" max	Medium fine 5/16" max	Fine 1/4" max
3/4"	100	--	--	--
1/2"	85–100	100	--	--
3/8"	0–30	85–100	100	100
No. 4	0–5	0–15	0–50	60–85
No. 8	--	0–5	0–15	0–25
No. 16	--	--	0–5	0–5
No. 30	--	--	0–3	0–3
No. 200	0–2	0–2	0–2	0–2

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The cleanness value determined under California Test 227 must be 86 or greater.

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### 37-2.04C(3) Construction

Polymer asphaltic emulsion must be applied within the application rate ranges shown in the following table:

**Polymer Asphaltic Emulsion Application Rates**

Screenings	Application rate range(gallons per square yard)
Fine	0.15–0.30
Medium fine	0.25–0.35
Medium	0.25–0.40
Coarse	0.30–0.40

Apply polymer asphaltic emulsion when the ambient air temperature is from 60 to 105 degrees F and the pavement surface temperature is at least 55 degrees F.

Do not apply polymer asphaltic emulsion when weather forecasts predict the ambient air temperature will fall below 39 degrees F within 24 hours after application.

For double asphaltic emulsion seal coat, polymer asphaltic emulsion must be applied within the application rates shown in the following table:

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:

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:

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:

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

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#### **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 test 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:

<b>Asphalt Modifier for Asphalt Rubber Binder</b>		
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 <sup>a</sup>	ASTM D7741/D7741M	Reaction vessel	1 per lot <sup>b</sup>
Viscosity at 375 °F	ASTM D7741/D7741M	Distribution truck	15 minutes before use per lot <sup>b</sup>
Cone penetration	ASTM D217	Distribution truck	1 per lot <sup>b</sup>
Resilience	ASTM D5329		
Softening point	ASTM D36/D36M		

<sup>a</sup>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.

<sup>b</sup>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 <sup>a</sup>	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

<sup>a</sup> 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 <sup>-3</sup> ) <sup>a</sup>	ASTM D7741/D7741M	1,500–2,500

<sup>a</sup> 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, %)	California Test 211	10		
Loss at 100 revolutions		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)	California Test 202	Coarse 1/2" max	Medium 1/2" max	Fine 3/8" max
Sieve sizes:				
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 <sup>2</sup> /s x 10 <sup>-6</sup> )	ASTM D445	X ± 3 <sup>a</sup>
Flash point (CL.O.C., °C)	ASTM D92	207 min
Molecular analysis	ASTM D2007	
Asphaltenes by mass (max, %)		0.1
Aromatics by mass (min, %)		55

<sup>a</sup> 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  $79 \pm 1$  percent by weight asphalt binder and  $21 \pm 1$  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 <sup>-3</sup> ) <sup>a</sup>	ASTM D7741/D7741M	1,500–2,500

<sup>a</sup>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.



## **39 HOT MIX ASPHALT**

01-15-16 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.

01-15-16

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 <sup>ε1</sup>
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 <sup>ε1</sup>
Asphalt Institute MS-2	7th edition (2015)

### 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.

**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

10-30-15

04-18-14

**processed RAP:** RAP that has been fractionated.

10-30-15

**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  $\pm 0.2$  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  $\pm 2.00$  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  $\pm 0.060$  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.

04-18-14

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.

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.

10-30-15

**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.

10-30-15

If a tapered notched wedge is used, submit compaction test result values within 24 hours of testing.

04-18-14

**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 antistriper collected from the liquid antistriper 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 antistriper content as percentage of the asphalt binder weight calculated from:
  - 2.9.1. Asphalt binder meter output
  - 2.9.2. Liquid antistriper 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 10-17-14
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. 04-18-14
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.

01-15-16

**39-1.01C(9)–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**

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

10-30-15

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\_TTCCRRR\_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  $7.0 \pm 1.0$  percent
2. Specimen height must be  $60 \pm 1$  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.

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For aggregate, RAP, and HMA, split the samples into at least 4 parts and label their containers. Submit 3 parts and keep 1 part.

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  $\pm 0.20$  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 antistriper producer, or new liquid antistriper 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:

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**Aggregate Quality Control During Lime Treatment**

Quality characteristic	Test method	Minimum sampling and testing frequency
Sand equivalent <sup>a, b</sup>	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	

<sup>a</sup>Report test results as the average of 3 tests from a single sample.

<sup>b</sup>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.

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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:

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.

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**

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.

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

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.

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### **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.

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3. Distance measurement index test. Verify the accuracy of the distance measuring instrument under California Test 387.

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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

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4. Begin and end of all at-grade intersections

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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:

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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

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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.

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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

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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.

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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**

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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.

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.

**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.

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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

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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).

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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 antistripping.

### **39-1.02B(3) Warm Mix Asphalt Technology**

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.

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For warm mix asphalt water injection foam technology, the use of foamed asphalt for mix design is not required.

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### **39-1.02C Asphalt Binder**

Asphalt binder must comply with section 92.

For hot mix asphalt (leveling) the grade of asphalt binder for the HMA must be PG 64-10 or PG 64-16.

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### **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.

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#### **39-1.02D(2) Aggregate Gradations**

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.

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Choose a target value within the target value limits shown in the tables titled "Aggregate Gradations."

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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  $\pm 0.2$  percent of the lime ratio in the accepted JMF. The lime ratio must be within  $\pm 0.2$  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*

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Proportion aggregate by hot or cold-feed control.

Aggregate temperature must not be more than 375 degrees F when mixed with the asphalt binder.

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  $\pm 1$  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  $\pm 2$  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  $\pm 0.3$  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  $\pm 0.5$  percent of the target additive weight. The indicated HMA additive batch scale weight may vary from the preselected weight setting by up to  $\pm 1.0$  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. 10-30-15
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. 04-18-14
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.

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#### **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.

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### **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

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.

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.

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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.

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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.

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).

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.

**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

If a stress absorbing membrane interlayer as specified in section 37-2.06 is applied, the tack coat application rates for new HMA apply.

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  $0.25 \pm 0.03$  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.

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#### **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  $\pm 5$  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.

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#### **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.

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Do not open new HMA pavement to traffic until its mid depth temperature is below 160 degrees F.

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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

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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**

01-15-16

The JMF must be based on superpave HMA mix design as described in *MS-2 Asphalt Mix Design Methods* 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:

### Aggregate Testing Frequencies

Quality characteristic	Test method	Minimum testing frequency
Gradation <sup>a</sup>	AASHTO T 27	1 per 750 tons and any remaining part
Sand equivalent <sup>b, c</sup>	AASHTO T 176	
Moisture content <sup>d</sup>	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	

<sup>a</sup>If RAP is used, test the combined aggregate gradation under California Test 384.

<sup>b</sup>Reported value must be the average of 3 tests from a single sample.

<sup>c</sup>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.

<sup>d</sup>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  $\pm 2.00$  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  $\pm 2.00$  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  $\pm 0.06$  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

01-15-16

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	MS-2 Asphalt Mixture Volumetrics	1 per 10,000 tons or 2 per project whichever is greater
Dust proportion	MS-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:

**Aggregate Quality**

Quality characteristic	Test method	Requirement	
Aggregate gradation <sup>a</sup>	AASHTO T 27	JMF ± Tolerance	
Percent of crushed particles	AASHTO T 335	95	
Coarse aggregate (min, %)			90
One-fractured face			
Two-fractured faces			
Fine aggregate (min, %)	AASHTO T 335	70	
(Passing No. 4 sieve			and retained on No. 8 sieve.)
One fractured face			
Los Angeles Rattler (max, %)	AASHTO T 96	12	
Loss at 100 Rev.			40
Loss at 500 Rev.			
Sand equivalent (min.) <sup>b, c</sup>	AASHTO T 176	47	
Flat and elongated particles (max, % by weight at 5:1)	ASTM D4791	10	
Fine aggregate angularity (min, %) <sup>d</sup>	AASHTO T 304 Method A	45	

<sup>a</sup>The Engineer determines combined aggregate gradations containing RAP under California Test 384.

<sup>b</sup>Reported value must be the average of 3 tests from a single sample.

<sup>c</sup>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.

<sup>d</sup>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.

04-18-14

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 $N_{\text{design}}$ (%) <sup>a, b</sup>	AASHTO T 269	4.0 ± 1.5 (5.0 ± 1.5 for 1-inch aggregate)
Voids in mineral aggregate on laboratory-produced HMA (min, %) <sup>a</sup> Gradation: No. 4 3/8-inch 1/2-inch 3/4-inch 1-inch with NMAS <sup>g</sup> = 1-inch with NMAS <sup>g</sup> = 3/4-inch	MS-2 Asphalt Mixture Volumetrics <sup>c</sup>	16.5–19.5 15.5–18.5 14.5–17.5 13.5–16.5 13.5–16.5 14.5–17.5
Voids in mineral aggregate on plant-produced HMA (min, %) <sup>a</sup> Gradation: No. 4 3/8-inch 1/2-inch 3/4-inch 1-inch with NMAS <sup>g</sup> = 1-inch with NMAS <sup>g</sup> = 3/4-inch	MS-2 Asphalt Mixture Volumetrics <sup>c</sup>	15.5–18.5 14.5–17.5 13.5–16.5 12.5–15.5 12.5–15.5 13.5–16.5
Dust proportion	MS-2 Asphalt Mixture Volumetrics	0.6–1.3 <sup>h</sup>
Density of core (% of max theoretical density) <sup>e, f</sup>	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 PG 76 or higher	AASHTO T 324 (Modified)	10,000 15,000 20,000 25,000
Hamburg wheel track (min number of passes at inflection point) Binder grade: PG 58 PG 64 PG 70 PG 76 or higher	AASHTO T 324 (Modified)	10,000 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

<sup>a</sup>Prepare 3 briquettes. Report the average of 3 tests.

<sup>b</sup>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.

<sup>c</sup>Determine bulk specific gravity under AASHTO T 275, Method A.

<sup>d</sup>The Engineer determines the laboratory-prepared HMA value for mix design verification only.

<sup>e</sup>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

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test maximum density

<sup>f</sup>The Engineer determines theoretical maximum density under AASHTO T 209, Method A, at the frequency specified in California Test 375, Part 5D.

<sup>g</sup>NMAS means nominal maximum aggregate size.

<sup>h</sup>For treated aggregate, the dust proportion requirement is 0.6–1.5.

04-18-14

## **39-2.02 MATERIALS**

### **39-2.02A General**

Reserved

### 39-2.02B Mix Design

01-15-16

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 <sup>a</sup>	$N_{\text{initial}} > 8.0$ $N_{\text{design}} = 4.0$ ( $N_{\text{design}} = 5.0$ for 1-inch aggregate) $N_{\text{max}} > 2.0$
Gyrations compaction (no. of gyrations)	AASHTO T 312	$N_{\text{initial}} = 8$ $N_{\text{design}} = 85.0$ $N_{\text{max}} = 130$
Voids in mineral aggregate (min, %) <sup>b</sup> Gradation: No. 4 3/8-inch 1/2-inch 3/4-inch 1-inch with NMA <sup>e</sup> = 1-inch with NMA <sup>e</sup> = 3/4-inch	MS-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	MS-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) <sup>c</sup>	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) <sup>c</sup>	10,000 10,000 12,500 15,000
Moisture susceptibility, dry strength (min, psi)	AASHTO T 283 <sup>c</sup>	100
Moisture susceptibility, wet strength (min, psi)	AASHTO T 283 <sup>c, d</sup>	70

<sup>a</sup>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.

<sup>b</sup>Measure bulk specific gravity using AASHTO T 275, Method A.

<sup>c</sup>Test plant produced HMA.

<sup>d</sup>Freeze thaw required.

<sup>e</sup>NMA<sup>s</sup> means nominal maximum aggregate size.

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.

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:

**Aggregate Quality**

Quality characteristic	Test method	Requirement
Percent of crushed particles	AASHTO T 335	95
Coarse aggregate (min, %)		
One-fractured face		90
Two-fractured faces		
Fine aggregate (min, %)	AASHTO T 335	70
(Passing No. 4 sieve and retained on No. 8 sieve.)		
One fractured face		
Los Angeles Rattler (max, %)	AASHTO T 96	12
Loss at 100 Rev.		
Loss at 500 Rev.		40
Sand equivalent (min) <sup>a, b</sup>	AASHTO T 176	47
Flat and elongated particles (max, % by weight at 5:1)	ASTM D4791	10
Fine aggregate angularity (min, %) <sup>c</sup>	AASHTO T 304 Method A	45

<sup>a</sup>Reported value must be the average of 3 tests from a single sample.

<sup>b</sup>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.

<sup>c</sup>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.

#### 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 <sup>a</sup>	100
Fine (% passing the 3/8-inch sieve)	California Test 202 <sup>a</sup>	98–100

<sup>a</sup>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  $\pm 3$  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.

04-18-14

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.

04-18-14

**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 superpave HMA mix design as described in *MS-2 Asphalt Mix Design Methods* 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.
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.

10-17-14

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.

04-18-14

### **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.

10-17-14

Take asphalt rubber binder samples from the feed line connecting the asphalt rubber binder tank to the HMA plant.

04-18-14

###### **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 <sup>a</sup>
Resilience	ASTM D5329	
Softening point	ASTM D36	
Viscosity	ASTM D7741	15 minutes before use per lot <sup>a</sup>

<sup>a</sup>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:

**Aggregate Testing Frequencies**

Quality characteristic	Test method	Minimum testing frequency
Gradation	AASHTO T 27	1 per 750 tons and any remaining part
Sand equivalent <sup>a, b</sup>	AASHTO T 176	
Moisture content <sup>c</sup>	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	

<sup>a</sup>Reported value must be the average of 3 tests from a single sample.

<sup>b</sup>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.

<sup>c</sup>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**

01-15-16

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	MS-2 Asphalt Mixture Volumetrics	1 per 10,000 tons or 2 per project whichever is greater
Dust proportion	MS-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	AASHTO T 335	
Coarse aggregate (min, %)		
One-fractured face		
Two-fractured faces	90	
Fine aggregate (min, %)	AASHTO T 335	
(Passing No. 4 sieve		
and retained on No. 8 sieve.)		
One fractured face	70	
Los Angeles Rattler (max, %)	AASHTO T 96	
Loss at 100 Rev.		
Loss at 500 Rev.		
		40
Sand equivalent (min) <sup>a, b</sup>	AASHTO T 176	47
Flat and elongated particles (max, % by weight at 5:1)	ASTM D4791	Report only
Fine aggregate angularity (min, %) <sup>c</sup>	AASHTO T 304 Method A	45

<sup>a</sup>Reported value must be the average of 3 tests from a single sample.

<sup>b</sup>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.

<sup>c</sup>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 <sub>design</sub> (%) <sup>a, b</sup>	AASHTO T 269	4.0 ± 1.5
Voids in mineral aggregate on laboratory-produced HMA <sup>d</sup> (min, %) Gradation: 1/2-inch and 3/4-inch	MS-2 Asphalt Mixture Volumetrics <sup>c</sup>	18.0–23.0
Voids in mineral aggregate on plant-produced HMA (min, %) <sup>a</sup> Gradation: 1/2-inch and 3/4-inch	MS-2 Asphalt Mixture Volumetrics <sup>c</sup>	18.0–23.0
Dust proportion <sup>a</sup>	MS-2 Asphalt Mixture Volumetrics	Report only
Density of core (% of max theoretical density) <sup>e, f</sup>	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

<sup>a</sup>Prepare 3 briquettes. Report the average of 3 tests.

<sup>b</sup>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.

<sup>c</sup>Determine bulk specific gravity under AASHTO T 275, Method A.

<sup>d</sup>The Engineer determines the laboratory-prepared RHMA-G value for mix design verification only.

<sup>e</sup>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.

<sup>f</sup>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 <sup>2</sup> /s x 10 <sup>-6</sup> )	ASTM D445	X ± 3 <sup>a</sup>
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

<sup>a</sup>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) <sup>a</sup>	ASTM D7741	1,500–4,000

<sup>a</sup>Prepare sample for viscosity test under California Test 388.

**39-3.01D(5)(c)–39-3.01D(5)(f) Reserved**

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**39-3.02 MATERIALS**

**39-3.02A General**

Reserved

### 39-3.02B Rubberized Hot Mix Asphalt–Gap Graded Mix Design

01-15-16

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 <sup>a</sup>	$N_{\text{design}} = 4.0$
Gyratory compaction (no. of gyrations)	AASHTO T 312	$N_{\text{design}} = 50-150^{\text{b}}$
Voids in mineral aggregate (min, %)	MS-2 Asphalt Mixture Volumetric <sup>c</sup>	18.0–23.0
Dust proportion	MS-2 Asphalt Mixture Volumetric	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) <sup>d</sup>	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) <sup>d</sup>	10,000 12,500 15,000
Moisture susceptibility, dry strength (min, psi)	AASHTO T 283 <sup>d</sup>	100
Moisture susceptibility, wet strength (min, psi)	AASHTO T 283 <sup>d, e</sup>	70

<sup>a</sup>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.

<sup>b</sup>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.

<sup>c</sup>Measure bulk specific gravity using AASHTO T 275, Method A.

<sup>d</sup>Test plant produced RHMA.

<sup>e</sup>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 <sup>2</sup> /s x 10 <sup>-6</sup> )	ASTM D445	X ± 3 <sup>a</sup>
Flash point (min, °C)	ASTM D92	207
Molecular Analysis		
Asphaltenes (max, % by mass)	ASTM D2007	0.1
Aromatics (min, % by mass)	ASTM D2007	55

<sup>a</sup>The symbol "X" is the proposed asphalt modifier viscosity. "X" must be between 19 and 36. A change in "X" requires a new asphalt rubber binder design.

Asphalt modifier must be from 2.0 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) <sup>a</sup>	--	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

<sup>a</sup>Test at mix design and for certificate of compliance.

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 <sup>a</sup>							Limits
		45	60	90	120	240	360	1440	
Cone penetration at 25 °C (0.10 mm)	ASTM D217	X <sup>b</sup>				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

<sup>a</sup>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).

<sup>b</sup>"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.

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#### 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) <sup>a</sup>	ASTM D7741	1,500–4,000

<sup>a</sup>Prepare sample for viscosity test under California Test 388.

Do not use asphalt rubber binder during the first 45 minutes of the reaction period. During this period, the asphalt rubber binder mixture must be between 375 degrees F and the lower of 425 or 25 degrees F below the asphalt binder's flash point indicated in the MSDS.

If any asphalt rubber binder is not used within 4 hours after the reaction period, discontinue heating. If the asphalt rubber binder drops below 375 degrees F, reheat before use. If you add more scrap tire 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.

### 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:

**Aggregate Quality**

Quality characteristic	Test method	Requirement
Percent of crushed particles	AASHTO T 335	--
Coarse aggregate (min, %)		
One-fractured face		
Two-fractured faces		
Fine aggregate (min, %)	AASHTO T 335	90
(Passing No. 4 sieve and retained on No. 8 sieve.)		
One fractured face		70
Los Angeles Rattler (max, %)	AASHTO T 96	12
Loss at 100 Rev.		40
Loss at 500 Rev.		
Sand equivalent (min) <sup>a, b</sup>	AASHTO T 176	47
Flat and elongated particles (max, % by weight at 5:1)	ASTM D4791	Report only
Fine aggregate angularity (min, %) <sup>c</sup>	AASHTO T 304 Method A	45

<sup>a</sup>Reported value must be the average of 3 tests from a single sample.

<sup>b</sup>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.

<sup>c</sup>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.

#### 39-3.02D(2) Aggregate Gradations

The aggregate gradations for RHMA-G must comply with the requirements shown in the following table:

**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.

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 to 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.

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).

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### 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:

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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
Moisture content <sup>a</sup>	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	

<sup>a</sup>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:

- 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

- 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.

BWC consists of placing a polymer modified asphaltic emulsion and the specified HMA in a single pass with an integrated paving machine.

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) <sup>a</sup>	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

<sup>a</sup>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) <sup>a</sup>	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

<sup>a</sup> 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

01-15-16

Use a material transfer vehicle when placing BWC. The material transfer vehicle must receive HMA directly from the truck.

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.

**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 <sup>a, b</sup>	AASHTO T 176	
Moisture content <sup>c</sup>	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	

<sup>a</sup>Reported value must be the average of 3 tests from a single sample.

<sup>b</sup>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.

<sup>c</sup>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	AASHTO T 335	90
Coarse aggregate (min, %)		
One-fractured face		
Two-fractured faces	85	
Fine aggregate (min, %)		
(Passing No. 4 sieve and retained on No. 8 sieve.)		
One fractured face	AASHTO T 96	12
Los Angeles Rattler (max, %)		
Loss at 100 Rev.		
Loss at 500 Rev.	AASHTO T 176	47
Sand equivalent (min)		
Flat and elongated particles (max, % by weight at 5:1)		
Fine aggregate angularity (min, %)		
	AASHTO T 304 Method A	45

<sup>a</sup>Reported value must be the average of 3 tests from a single sample.

<sup>b</sup>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.

04-18-14

**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.

01-15-16

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, $\mu\text{m}$ )	Asphalt Institute MS-2 Table 8.1 <sup>a</sup>	12
Drain down (max, %)	AASHTO T 305 <sup>b</sup>	0.1

<sup>a</sup> 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  $\mu\text{m}$

$P_{be}$  = Effective asphalt content by total weight of mix using the MS-2 Asphalt Mix Design Methods

SA = Estimated surface area of the aggregate blend in  $\text{m}^2/\text{kg}$  from Table 8.1 in the Asphalt Institute MS-2 Asphalt Mix Design Methods, 7th Edition

$G_b$  = Specific gravity of asphalt binder

<sup>b</sup> 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	AASHTO T 335	90
Coarse aggregate (min, %)		
One-fractured face		
Two-fractured faces		
Fine aggregate (min, %)	AASHTO T 335	85
(Passing No. 4 sieve		
and retained on No. 8 sieve.)		
One fractured face		
Los Angeles Rattler (max, %)	AASHTO T 96	12
Loss at 100 Rev.		
Loss at 500 Rev.		
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

<sup>a</sup>Reported value must be the average of 3 tests from a single sample.

<sup>b</sup>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.

The aggregate gradations for BWC-G must comply with the requirements shown in the following table:

**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

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**

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.



## 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:

<b>QC Testing Frequency</b>		
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 <sup>a</sup>	California Test 223 or California Test 226	1 per day

<sup>a</sup> 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  $\pm 1.0$  percent of the specified value. If no value is specified, the action limit is  $\pm 1.0$  percent of the value used for your approved mix design.

As a minimum, a process is out of control if any of the following occurs:

1. For fine and coarse aggregate gradation, 2 consecutive running averages of 4 tests are outside the specification limits
2. For individual penetration or air content measurements:
  - 2.1. One point falls outside the suspension limit line
  - 2.2. Two points in a row fall outside the action limit line

Stop production and take corrective action for out of control processes or the Engineer rejects subsequent material.

Before each day's concrete pavement placement and at intervals not to exceed 4 hours of production, use a tachometer to test and record vibration frequency for concrete consolidation vibrators.

#### **40-1.01D(6)(c) Pavement Smoothness**

##### **40-1.01D(6)(c)(i) General**

Notify the Engineer 2 business days before performing smoothness testing including IP calibration and verification testing. The notification must include start time and locations by station.

Before testing the pavement smoothness, remove foreign objects from the surface, and mark the beginning and ending station on the pavement shoulder.

Test pavement smoothness using an IP except use a 12-foot straightedge at the following locations:

1. Traffic lanes less than 1,000 feet in length including ramps, turn lanes, and acceleration and deceleration lanes
2. Areas within 15 feet of manholes
3. Shoulders
4. Weigh-in-motion areas
5. Miscellaneous areas such as medians, gore areas, turnouts, and maintenance pullouts

##### **40-1.01D(6)(c)(ii) Straightedge Testing**

Identify locations of areas requiring correction by:

1. Location Number
2. District-County-Route
3. Beginning station or post mile to the nearest 0.01 mile
4. For correction areas within a lane:
  - 4.1. Lane direction as NB, SB, EB, or WB
  - 4.2. Lane number from left to right in direction of travel
  - 4.3. Wheel path as "L" for left, "R" for right, or "B" for both
5. For correction areas not within a lane:
  - 5.1. Identify pavement area (e.g., shoulder, weight station, turnout)
  - 5.2. Direction and distance from centerline as "L" for left or "R" for right
6. Estimated size of correction area

##### **40-1.01D(6)(c)(iii) Inertial Profile Testing**

IP equipment must display a current certification decal with expiration date.

Conduct cross correlation IP verification test in the Engineer's presence before performing initial profiling. Verify cross correlation IP verification test at least annually. Conduct 5 repeat runs of the IP on an authorized test section. The test section must be on an existing concrete pavement surface 0.1 mile long.

Calculate a cross correlation to determine the repeatability of your device under Section 8.3.1.2 of AASHTO R 56 using ProVAL profiler certification analysis with a 3 feet maximum offset. The cross correlation must be a minimum of 0.92.

Conduct the following IP calibration and verification tests in the Engineer's presence each day before performing inertial profiling:

1. Block test. Verify the height sensor accuracy under AASHTO R 57, section 5.3.2.3.
2. Bounce test. Verify the combined height sensor and accelerometer accuracy under AASHTO R 57, section 5.3.2.3.2.
3. DMI test. Calibrate the accuracy of the testing procedure under AASHTO R 56, section 8.4.
4. Manufacturer's recommended tests.

Collect IP data using the specified ProVAL analysis with 250 mm and IRI filters. Comply with the requirements for data collection under AASHTO R 56.

For IP testing, wheel paths are 3 feet from and parallel to the edge of a lane. Left and right are relative to the direction of travel. The IRI is the pavement smoothness along a wheel path of a given lane. The MRI is the average of the IRI values for the left and right wheel path from the same lane.

Operate the IP according to the manufacturer's recommendations and AASHTO R 57 at 1-inch recording intervals and a minimum 4 inch line laser sensor.

Collect IP data under AASHTO R 56. IP data must include:

1. Raw profile data for each lane.
2. ProVAL ride quality analysis report for the international roughness index (IRI) of left and right wheel paths of each lane. Submit in pdf file format.
3. ProVAL ride quality analysis report for the mean roughness index (MRI) of each lane. Submit in pdf file format.
4. ProVAL smoothness assurance analysis report for IRIs of left wheel path. Submit in pdf file format.
5. ProVAL smoothness assurance analysis report for IRIs of right wheel path. Submit in pdf file format.
6. GPS data file for each lane in GPS exchange. Submit in GPS eXchange file format.
7. Manufacturer's recommended IP calibration and verification tests results.
8. AASHTO IP calibration and verification test results including bounce, block, and distance measurement instrument (DMI).

Submit the IP raw profile data in unfiltered electronic pavement profile file (PPF) format. Name the PPF file using the following naming convention:

YYYYMMDD\_TTCCRRR\_D\_L\_W\_S\_X\_PT.PPF

where:

YYYY = year

MM = Month, leading zero

DD = Day of month, leading zero

TT = District, leading zero

CCC = County, 2 or 3 letter abbreviation as shown in section 1-1.08

RRR = Route number, no leading zeros

D = Traffic direction as NB, SB, WB, or EB

L = Lane number from left to right in direction of travel

W = Wheel path as "L" for left, "R" for right, or "B" for both

S = Beginning station to the nearest foot (e.g., 10+20) or beginning post mile to the nearest hundredth (e.g., 25.06) no leading zero

X = Profile operation as "EXIST" for existing pavement, "PAVE" for after paving, or "CORR" for after final surface pavement correction

PT = Pavement type (e.g., "concrete", etc.)

Determine IRIs using the ProVAL ride quality analysis with a 250 mm and IRI filters. While collecting the profile data to determine IRI, record the following locations in the raw profile data:

1. Begin and end of all bridge approach slabs
2. Begin and end of all bridges
3. Begin and end of all culverts visible on the roadway surface

For each 0.1 mile section, your IRI values must be within 10 percent of the Department's IRI values. The Engineer may order you to recalibrate your IP equipment and reprofile. If your results are inaccurate due to operator error, the Engineer may disqualify your IP operator.

Determine the MRI for 0.1-mile fixed sections. A partial section less than 0.1 mile that is the result of an interruption to continuous pavement surface must comply with the MRI specifications for a full section. Adjust the MRI for a partial section to reflect a full section based on the proportion of a section paved.

Determine the areas of localized roughness. Use the ProVAL smoothness assurance with a continuous IRI for each wheel path, 25-foot interval, and 250 mm and IRI filters.

**40-1.01D(6)(c)(iv) Reserved**

**40-1.01D(6)(d)–40-1.01D(6)(h) Reserved**

**40-1.01D(7) Pavement Acceptance**

**40-1.01D(7)(a) Acceptance Testing**

**40-1.01D(7)(a)(i) General**

The Department's acceptance testing includes testing the pavement properties at the minimum frequencies shown in the following table:

Property	Acceptance Testing Test Method		Frequency <sup>a</sup>
	CRCP	JPCP	
Modulus of rupture (28 day)	California Test 523		1,000 cu yd
Air content <sup>b</sup>	California Test 504		1 day's paving
Dowel bar placement	--	Measurement <sup>a</sup>	700 sq yd
Tie bar placement	--	Measurement <sup>a</sup>	4,000 sq yd
Thickness	California Test 531		1,200 sq yd
Coefficient of friction	California Test 342		1 day's paving

<sup>a</sup>A single test represents no more than the frequency specified.

<sup>b</sup>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:

$$t = \frac{|\bar{X}_c - \bar{X}_v|}{S_p \sqrt{\frac{1}{n_c} + \frac{1}{n_v}}} \quad \text{and} \quad S_p^2 = \frac{S_c^2(n_c - 1) + S_v^2(n_v - 1)}{n_c + n_v - 2}$$

where:

- $n_c$  = Number of your quality control tests (minimum of 6 required)
- $n_v$  = Number of Department's tests (minimum of 2 required)
- $\bar{X}_c$  = Mean of your quality control tests
- $\bar{X}_v$  = Mean of the Department's tests
- $S_p$  = Pooled standard deviation  
(When  $n_v = 1$ ,  $S_p = S_c$ )
- $S_c$  = Standard deviation of your quality control tests

$S_v$  = Standard deviation of the Department's tests (when  $n_v > 1$ )

The Engineer compares your QC test results with the Department's test results at a level of significance of  $\alpha = 0.01$ . The Engineer compares the t-value to  $t_{crit}$ , using degrees of freedom showing in the following table:

degrees of freedom ( $nc+nv-2$ )	$t_{crit}$ (for $\alpha = 0.01$ )
1	63.657
2	9.925
3	5.841
4	4.604
5	4.032
6	3.707
7	3.499
8	3.355
9	3.250
10	3.169

If the t-value calculated is less than or equal to  $t_{crit}$ , your quality control test results are verified. If the t-value calculated is greater than  $t_{crit}$ , quality control test results are not verified.

If your quality control test results are not verified, core at least 3 specimens from concrete pavement under section 40-1.03P. 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  $\pm 1.5$  percent of the specified value. If no value is specified, the air content must be within  $\pm 1.5$  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:

<b>Tie Bar Tolerance</b>	
Dimension	Tolerance
Horizontal and vertical skew	5 1/4 inch, max
Longitudinal translation	$\pm 2$ inch
Horizontal offset (embedment)	$\pm 2$ 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	<p>The minimum distance measured from concrete pavement surface to any point along the top of dowel bar must be: DB + 1/2 inch</p> <p>where: DB = one third of pavement thickness in inches, or the saw cut depth, whichever is greater</p> <p>The maximum distance below the depth shown must be 5/8 inch.</p>

NOTE: Tolerances are measured relative to the completed joint.

The Engineer determines the limits for removal and replacement.

#### **40-1.01D(7)(b)(vi) Pavement Thickness**

Concrete pavement thickness must not be deficient by more than 0.05 foot.

The minimum thickness is not reduced for specifications that may affect concrete pavement thickness such as allowable tolerances for subgrade construction.

The Engineer determines the areas of noncompliant pavement, the thickness deficiencies, and the limits where removal is required.

Pavement with an average thickness deficiency less than 0.01 foot is acceptable. If the thickness deficiency is 0.01 foot or more and less than 0.05 foot, you may request authorization to leave the pavement in place and accept a pay adjustment. If the deficiency is more than 0.05 foot the pavement must be removed and replaced.

#### **40-1.01D(7)(b)(vii) Pavement Smoothness**

Where testing with an IP is required, the pavement surface must have:

1. No areas of localized roughness with an IRI greater than 120 in/mi
2. MRI of 60 in/mi or less within a 0.1 mile section

Where testing with a straightedge is required, the pavement surface must not vary from the lower edge of the straightedge by more than:

1. 0.01 foot when the straightedge is laid parallel with the centerline
2. 0.02 foot when the straightedge is laid perpendicular to the centerline and extends from edge to edge of a traffic lane
3. 0.02 foot when the straightedge is laid within 24 feet of a pavement conform

#### **40-1.01D(7)(b)(viii) Coefficient of Friction**

Initial and final texturing must produce a coefficient of friction of at least 0.30. Do not open the pavement to traffic unless the coefficient of friction is at least 0.30.

**40-1.01D(7)(b)(ix)–40-1.01D(7)(b)(xii) Reserved**

**40-1.02 MATERIALS**

**40-1.02A General**

Water for coring must comply with section 90.

Tack coat must comply with section 39.

**40-1.02B Concrete**

**40-1.02B(1) General**

PCC for pavement must comply with section 90-1 except as otherwise specified.

**40-1.02B(2) Cementitious Material**

Concrete must contain from 505 pounds to 675 pounds cementitious material per cubic yard. The specifications for reducing cementitious material content in section 90-1.02E(2) do not apply .

**40-1.02B(3) Aggregate**

Aggregate must comply with section 90-1.02C except the specifications for reduction in operating range and contract compliance for cleanness value and sand equivalent specified in section 90-1.02C(2) and section 90-1.02C(3) do not apply.

For coarse aggregate in high desert and high mountain climate regions, the loss must not exceed 25 percent when tested under California Test 211 with 500 revolutions.

For combined aggregate gradings, the difference between the percent passing the 3/8-inch sieve and the percent passing the no. 8 sieve must not be less than 16 percent of the total aggregate.

**40-1.02B(4) Air Entrainment**

The second paragraph of section 90-1.02I(2)(a) does not apply.

For a project shown in the low and south mountain climate regions, add air-entraining admixture to the concrete at the rate required to produce an air content of 4 percent in the freshly mixed concrete.

For a project shown in the high desert and high mountain climate regions, add air-entraining admixture to the concrete at the rate required to produce an air content of 6 percent in the freshly mixed concrete.

**40-1.02B(5)–40-1.02B(8) Reserved**

**40-1.02C Reinforcement, Bars, and Baskets**

**40-1.02C(1) Bar Reinforcement**

Bar reinforcement must be deformed bars.

If the project is not shown to be in high desert or any mountain climate region, bar reinforcement must comply with section 52.

If the project is shown to be in high desert or any mountain climate regions, bar reinforcement must be one of the following:

1. Epoxy-coated bar reinforcement under section 52-2.03B except bars must comply with either ASTM A 706/A 706M; ASTM A 996/A 996M; or ASTM A 615/A 615M, Grade 40 or 60. Bars must be handled under ASTM D 3963/D 3963M and section 52-2.02C.
2. Low carbon, chromium steel bar complying with ASTM A 1035/A 1035M

**40-1.02C(2) Dowel Bars**

Dowel bars must be plain bars. Fabricate, sample, and handle epoxy-coated dowel bars under ASTM D 3963/D 3963M and section 52-2.03C except each sample must be 18 inches long.

If the project is not shown to be in high desert or any mountain climate region, dowel bars must be one of the following:

1. Epoxy-coated bars. Bars must comply with ASTM A 615/A 615M, Grade 40 or 60. Epoxy coating must comply with either section 52-2.02B or 52-2.03B.

2. Stainless-steel bars. Bars must be descaled solid stainless-steel bars under ASTM A 955/A 955M, UNS Designation S31603 or S31803.
3. Low carbon, chromium-steel bars under ASTM A 1035/A 1035M.

If the project is shown to be in high desert or any mountain climate region, dowel bars must be one of the following:

1. Epoxy-coated bars. Bars must comply with ASTM A 615/A 615M, Grade 40 or 60. Epoxy coating must comply with section 52-2.03B.
2. Stainless-steel bars. Bars must be descaled solid stainless-steel bars under ASTM A 955/A 955M, UNS Designation S31603 or S31803.

#### **40-1.02C(3) Tie Bars**

Tie bars must be deformed bars.

If the project is not shown to be in high desert or any mountain climate region, tie bars must be one of the following:

1. Epoxy-coated bar reinforcement. Bars must comply with either section 52-2.02B or 52-2.03B except bars must comply with either ASTM A 706/A 706M; ASTM A 996/A 996M; or ASTM A 615/A 615M, Grade 40 or 60.
2. Stainless-steel bars. Bars must be descaled solid stainless-steel bars under ASTM A 955/A 955M, UNS Designation S31603 or S31803.
3. Low carbon, chromium-steel bars under ASTM A 1035/A 1035M.

If the project is shown to be in high desert or any mountain climate region, tie bars must be one of the following:

1. Epoxy-coated bar reinforcement. Bars must comply with section 52-2.03B except bars must comply with either ASTM A 706/A 706M; ASTM A 996/A 996M; or ASTM A 615/A 615M, Grade 40 or 60.
2. Stainless-steel bars. Bars must be descaled solid stainless-steel bars under ASTM A 955/A 955M, UNS Designation S31603 or S31803.

Fabricate, sample, and handle epoxy-coated tie bars under ASTM D 3963/D 3963M, section 52-2.02, or section 52-2.03.

Do not bend tie bars.

#### **40-1.02C(4) Dowel and Tie Bar Baskets**

For dowel and tie bar baskets, wire must comply with ASTM A 82/A 82M and be welded under ASTM A 185/A 185M, Section 7.4. The minimum wire-size no. is W10. Use either U-frame or A-frame shaped assemblies.

If the project is not shown to be in high desert or any mountain climate region, baskets may be epoxy-coated, and the epoxy coating must comply with either section 52-2.02B or 52-2.03B.

If the project is shown to be in high desert or any mountain climate region, wire for dowel bar and tie bar baskets must be one of the following:

1. Epoxy-coated wire complying with section 52-2.03B
2. Stainless-steel wire. Wire must be descaled solid stainless-steel. Wire must comply with (1) the chemical requirements in ASTM A 276/A 276M, UNS Designation S31603 or S31803 and (2) the tension requirements in ASTM A 1022/ A 1022M.

Handle epoxy-coated tie bar and dowel bar baskets under ASTM D 3963/D 3963M and either section 52-2.02 or 52-2.03.

Fasteners must be driven fasteners under ASTM F 1667. Fasteners on lean concrete base or HMA must have a minimum shank diameter of 3/16 inch and a minimum shank length of 2-1/2 inches. For asphalt treated permeable base or cement treated permeable base, the shank diameter must be at least 3/16 inch and the shank length must be at least 5 inches.

Fasteners, clips, and washers must have a minimum 0.2-mil thick zinc coating applied by either electroplating or galvanizing.

**40-1.02D Dowel Bar Lubricant**

Dowel bar lubricant must be petroleum paraffin based or a curing compound. Paraffin-based lubricant must be Dayton Superior DSC BB-Coat or Valvoline Tectyl 506 or an approved equal and must be factory-applied. Curing compound must be curing compound no. 3.

**40-1.02E Joint Filler**

Joint filler for isolation joint must be preformed expansion joint filler for concrete (bituminous type) under ASTM D 994.

**40-1.02F Curing Compound**

Curing compound must be curing compound no. 1 or 2.

**40-1.02G Nonshrink Hydraulic Cement Grout**

Nonshrink hydraulic cement grout must comply with ASTM C 1107/C 1107M. Clean, uniform, rounded aggregate filler may be used to extend the grout. Aggregate filler must not exceed 60 percent of the grout mass or the maximum recommended by the manufacturer, whichever is less. Aggregate filler moisture content must not exceed 0.5 percent when tested under California Test 223 or California Test 226. Aggregate filler tested under California Test 202 must comply with the grading shown in the following table:

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  $\pm 5$  degrees from the angle shown. Measure the angle from the plane of the adjacent finished pavement surface.

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#### **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  $20 \pm 5$  feet from the transverse construction joint formed at each day's start of paving and  $1 \pm 0.25$  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.

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#### **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:

<b>Deduction for Thickness Deficiency</b>	
Average thickness deficiency (foot) <sup>a</sup>	Deduction(\$/sq yd)
0.01	0.90
0.02	2.30
0.03	4.10
0.04	6.40
0.05	9.11

<sup>a</sup>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.



**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:

<b>Fast-Setting Concrete</b>		
Property	Test method	Value
Compressive strength <sup>a</sup> (psi, min)		
at 3 hours	California Test 551	3,000
at 24 hours	California Test 551	5,000
Flexural strength <sup>a</sup> (psi, min, at 24 hours)	California Test 551	500
Bond strength <sup>a</sup> (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 <sup>a</sup> (g, max, at 24 hours)	California Test 550	25
Drying shrinkage (% , max, at 4 days)	ASTM C596	0.13
Water soluble chlorides <sup>b</sup> (% , max, by weight)	California Test 422	0.05
Water soluble sulfates <sup>b</sup> (% , max, by weight)	California Test 417	0.25
Thermal stability (% , min)	California Test 553	90

<sup>a</sup>Perform test with aggregate filler if used.

<sup>b</sup>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 <sup>a</sup> (Pa·s) RVT, No. 1 spindle, 20 RPM at 77 °F	ASTM D2196	0.075–0.200
Specific gravity <sup>a</sup> (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	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 <sup>a</sup> (% 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 <sup>a</sup> (g/sq m, max)	South Coast Air Quality Management District, Method 309-91 <sup>b</sup>	60

<sup>a</sup>Perform the test before adding initiator.

<sup>b</sup>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 <sup>a</sup> (cP, max, Brookfield RVT with UL adapter, 50 RPM at 77 °F)	ASTM D2196	25
Specific gravity <sup>a</sup> (min, at 77 °F)	ASTM D1475	0.90
Flash point <sup>a</sup> (°F, min)	ASTM D3278	180
Vapor pressure <sup>a</sup> (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 <sup>a</sup> (% , max)	ASTM D2369	30
PCC saturated surface-dry bond strength (psi, min, at 24 hours and 77 ± 2 °F)	California Test 551	500

<sup>a</sup>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 <sup>a</sup>
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 <sup>b</sup>	California Test 223 or California Test 226	1 per shift
Modulus of rupture	California Test 524	Comply with section 41-9.01D(6)(a)

<sup>a</sup>Test at the most frequent interval.

<sup>b</sup>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  $\pm 1.0$  percent and the suspension limit is  $\pm 1.5$  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



#### **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).



**Add to section 46-1.02:**

07-19-13

**46-1.02C Grout**

Grout must consist of cement and water and may contain an admixture if authorized. Cement must comply with section 90-1.02B(2). Water must comply with section 90-1.02D. Admixtures must comply with section 90, except they must not contain chloride ions in excess of 0.25 percent by weight. Do not exceed 5 gallons of water per 94 lb of cement.

Mix the grout as follows:

1. Add water to the mixer followed by cement and any admixtures or fine aggregate.
2. Mix the grout with mechanical mixing equipment that produces a uniform and thoroughly mixed grout.
3. Agitate the grout continuously until the grout is pumped.
4. Do not add water after the initial mixing.

**Add to section 46-1.03B:**

04-20-12

Dispose of drill cuttings under section 19-2.03B.

**Add to the end of section 46-1.03C:**

07-19-13

Grouting equipment must be:

1. Capable of grouting at a pressure of at least 100 psi
2. Equipped with a pressure gage having a full-scale reading of not more than 300 psi

**Delete the 3rd paragraph of section 46-2.01A.**

07-19-13

**Add to the beginning of section 46-2.01C:**

07-19-13

Submittals for strand tendons, bar tendons, bar couplers, and anchorage assemblies must comply with section 50-1.01C.

**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.



### **47-3.02 Materials**

#### **47-3.02A General**

Pads shown to be placed between bearing surfaces must either be (1) neoprene complying with the specifications for strip waterstops in section 51-2.05 or (2) commercial quality no. 30 asphalt felt. The protective board is not required for neoprene pads.

#### **47-3.02B Crib Members**

##### **47-3.02B(1) General**

All members may be manufactured to dimensions 1/8 inch greater in thickness than shown. The thickness of the lowest step must not be less than the dimension shown.

Stretchers may be manufactured 1/2 inch less in length than shown.

When an opening is shown in the face of the wall, special length stretchers and additional headers may be necessary.

For non-tangent wall alignments, special length stretchers may be required.

For non-tangent wall alignments and at locations where filler blocks are required, special length front face closure members may be required.

##### **47-3.02B(2) Reinforcement**

Reinforcing wire must comply with ASTM A 496/A 496M.

For hoops or stirrups use either (1) reinforcing wire or (2) deformed steel welded wire reinforcement. The size must be equivalent to the reinforcing steel shown. Deformed steel welded wire reinforcement must comply with ASTM A 497/A 497M.

##### **47-3.02B(3) Concrete**

Concrete test cylinders must comply with section 90-1.01D(5), except when the penetration of fresh concrete is less than 1 inch, the concrete in the test mold must be consolidated by vibrating the mold equivalent to the consolidating effort being used to consolidate the concrete in the members.

Cure crib members under section 51-4.02C.

When removed from forms, the members must present a true surface of even texture, free from honeycombs and voids larger than 1 inch in diameter and 5/16 inch in depth. Clean and fill other pockets with mortar under sections 51-1.02F and 51-1.03E(2).

External vibration resulting in adequate consolidation may be used.

If the Engineer determines that rock pockets are of the extent or character as to affect the strength of the member or to endanger the life of the steel reinforcement, replace the member.

Finish concrete-to-concrete bearing surfaces to a smooth plane. Section 51-1.03F does not apply to concrete crib members.

#### **47-3.03 Construction**

Place reinforced concrete crib walls to the lines and grades established by the Engineer. The foundation must be accepted by the Engineer before any crib members are placed.

The gap between bearing surfaces must not exceed 1/8 inch.

Where a gap of 1/16 inch to 1/8 inch exists or where shown, place a 1/16-inch pad of asphalt felt or sheet neoprene between the bearing surfaces.

#### **47-3.04 Payment**

The area of reinforced concrete crib wall is measured on the batter at the outer face for the height from the bottom of the bottom stretcher to the top of the top stretcher and for a length measured from end to end of each section of wall.

**Add between the 3rd and 4th paragraphs of section 47-5.01:**

Reinforcement must comply with section 52. 10-19-12

**Add to section 47-6.01A:**

The alternative earth retaining system must comply with the specifications for the type of wall being constructed. 10-19-12

**Replace "sets" at each occurrence in the 1st paragraph of section 47-6.01C with:**

copies 04-19-13

AA

**48 TEMPORARY STRUCTURES**

07-19-13

**Replace "previously welded splice" and its definition in section 48-2.01B with:**

**previously welded splice:** Splice made in a falsework member in compliance with AWS D1.1 or other recognized welding standard before contract award. 04-19-13

**Add to section 48-2.01B:**

**independent support system:** Support system that is in addition to the falsework removal system employing methods of holding falsework from above by winches, hydraulic jacks with prestressing steel, HS rods, or cranes. 07-19-13

**Delete "field" in the 1st sentence of the 5th paragraph of section 48-2.01C(1).**

04-19-13

**Replace item 1 in the list in the 6th paragraph of section 48-2.01C(1) with:**

1. Itemize the testing, inspection methods, and acceptance criteria used 04-19-13

**Replace "sets" at each occurrence in the 4th paragraph of section 48-2.01C(2) with:**

copies 07-19-13

**Replace the 7th paragraph of section 48-2.01C(2) with:**

If you submit multiple submittals at the same time or additional submittals before review of a previous submittal is complete: 09-16-11

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.



**Replace the paragraph of section 49-2.02A(1) with:**

Section 49-2.02 includes specifications for fabricating and installing steel pipe piles.

07-19-13

**Replace the definitions in section 49-2.02A(2) with:**

**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.

07-19-13

**Replace item 2 in the list in the paragraph of section 49-2.02A(3)(b) with:**

2. Certified mill test reports for each heat number of steel used in pipe piles being furnished.

07-19-13

**Replace the paragraph of section 49-2.02A(4)(a) with:**

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.

07-19-13

**Replace "0.45" in the 2nd paragraph of section 49-2.02B(1)(a) with:**

0.47

07-19-13

**Replace the 1st paragraph of section 49-2.02B(1)(b) with:**

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).**

07-19-13

**Add to section 49-2.02B(1):**

**49-2.02B(1)(d) Reserved**

07-19-13

**Replace "4.8.4" in item 2.3 in the list in the 2nd paragraph of section 49-2.02B(2) with:**

4.9.4

07-19-13

**Delete the 3rd paragraph of section 49-2.02C(2).**

07-19-13

**Replace the paragraph of section 49-2.03A(1) with:**

07-19-13

Section 49-2.03 includes specifications for fabricating and installing structural shape steel piles.

**Replace the paragraph of section 49-2.03A(3) with:**

07-19-13

Submit a certified material test report and a certificate of compliance that includes a statement that all materials and workmanship incorporated in the work and all required tests and inspections of this work have been performed as described.

**Replace the 1st paragraph of section 49-2.03B with:**

07-19-13

Structural shape steel piles must comply with ASTM A 36/A 36M, ASTM A 572/A 572M, ASTM A 709/A 709M, or ASTM A 992/A 992M.

**Replace "sets" in the 1st paragraph of section 49-2.04A(3) with:**

04-19-13

copies

**Delete the 1st paragraph of section 49-2.04A(4).**

07-19-13

**Replace the 3rd and 4th paragraphs of section 49-2.04B(2) with:**

10-19-12

Piles in a corrosive environment must be steam or water cured under section 90-4.03.

If piles in a corrosive environment are steam cured, either:

1. Keep the piles continuously wet for at least 3 days. The 3 days includes the holding and steam curing periods.
2. Apply curing compound under section 90-1.03B(3) after steam curing.

**Replace the 1st paragraph of section 49-3.01A with:**

07-19-13

Section 49-3.01 includes general specifications for constructing CIP concrete piles.

**Add to section 49-3.01A:**

01-20-12

Concrete must comply with section 51.

**Replace the 1st paragraph of section 49-3.01C with:**

01-20-12

Except for CIDH concrete piles constructed under slurry, construct CIP concrete piles such that the excavation methods and the concrete placement procedures provide for placing the concrete against undisturbed material in a dry or dewatered hole.

**Replace "Reserved" in section 49-3.02A(2) with:**

01-20-12

**dry hole:**

1. Except for CIDH concrete piles specified as end bearing, a drilled hole that:
  - 1.1. Accumulates no more than 12 inches of water in the bottom of the drilled hole during a period of 1 hour without any pumping from the hole during the hour.
  - 1.2. Has no more than 3 inches of water in the bottom of the drilled hole immediately before placing concrete.
2. For CIDH concrete piles specified as end bearing, a drilled hole free of water without the use of pumps.

**Replace "Reserved" in section 49-3.02A(3)(a) with:**

01-20-12

If plastic spacers are proposed for use, submit the manufacturer's data and a sample of the plastic spacer. Allow 10 days for review.

**Replace item 5 in the list in the 1st paragraph of section 49-3.02A(3)(b) with:**

10-19-12

5. Methods and equipment for determining:
  - 5.1. Depth of concrete
  - 5.2. Theoretical volume of concrete to be placed, including the effects on volume if casings are withdrawn
  - 5.3. Actual volume of concrete placed

**Add to the list in the 1st paragraph of section 49-3.02A(3)(b):**

01-18-13

8. Drilling sequence and concrete placement plan.

**Replace item 2 in the list in the 1st paragraph of section 49-3.02A(3)(g) with:**

01-20-12

2. Be sealed and signed by an engineer who is registered as a civil engineer in the State. This requirement is waived for either of the following conditions:
  - 2.1. The proposed mitigation will be performed under the current Department-published version of *ADSC Standard Mitigation Plan 'A' - Basic Repair* without exception or modification.
  - 2.2. The Engineer determines that the rejected pile does not require mitigation due to structural, geotechnical, or corrosion concerns, and you elect to repair the pile using the current Department-published version of *ADSC Standard Mitigation Plan 'B' - Grouting Repair* without exception or modification.

**Replace "49-2.03A(4)(d)" in the 1st paragraph of section 49-3.02A(4)(d)(i) with:**

07-19-13

49-3.02A(4)(d)

**Add to the beginning of section 49-3.02A(4)(d)(ii):**

07-19-13

If the drilled hole is dry or dewatered without the use of temporary casing to control ground water, installation of inspection pipes is not required.

**Replace item 1 in the list in the 1st paragraph of section 49-3.02A(4)(d)(ii) with:**

01-20-12

1. Inspection pipes must be schedule 40 PVC pipe complying with ASTM D 1785 with a nominal pipe size of 2 inches. Watertight PVC couplers complying with ASTM D 2466 are allowed to facilitate pipe lengths in excess of those commercially available. Log the location of the inspection pipe couplers with respect to the plane of pile cutoff.

**Add to section 49-3.02A(4)(d)(iv):**

01-20-12

If the Engineer determines it is not feasible to use one of ADSC's standard mitigation plans to mitigate the pile, schedule a meeting and meet with the Engineer before submitting a nonstandard mitigation plan.

The meeting attendees must include your representatives and the Engineer's representatives involved in the pile mitigation. The purpose of the meeting is to discuss the type of pile mitigation acceptable to the Department.

Provide the meeting facility. The Engineer conducts the meeting.

**Replace the 1st paragraph of section 49-3.02B(5) with:**

07-19-13

Grout must consist of cementitious material and water, and may contain an admixture if authorized. Do not exceed 5 gallons of water per 94 lb of cement.

Cementitious material must comply with section 90-1.02B, except SCMs are not required.

Water must comply with section 90-1.02D. If municipally supplied potable water is used, the testing specified in section 90-1.02D is waived.

Admixtures must comply with section 90, except admixtures must not contain chloride ions in excess of 0.25 percent by weight.

Use aggregate to extend the grout as follows:

1. Aggregate must consist of at least 70 percent fine aggregate and approximately 30 percent pea gravel, by weight.
2. Fine aggregate must comply with section 90-1.02C(3).
3. Size of pea gravel must be such that 100 percent passes the 1/2-inch sieve, at least 85 percent passes the 3/8-inch sieve, and not more than 5 percent passes the no. 8 sieve.
4. Minimum cementitious material content of the grout must not be less than 845 lb/cu yd of grout.

Mix the grout as follows:

1. Add water to the mixer followed by cementitious material, aggregates, and any admixtures.
2. Mix the grout with mechanical mixing equipment that produces a uniform and thoroughly mixed grout.
3. Agitate the grout continuously until the grout is pumped.
4. Do not add water after initial mixing.

**Replace section 49-3.02B(8) with:**

01-20-12

**49-3.02B(8) Spacers**

Spacers must comply with section 52-1.03D, except you may use plastic spacers.

Plastic spacers must:

1. Comply with sections 3.4 and 3.5 of the Concrete Reinforcing Steel Institute's *Manual of Standard Practice*
2. Have at least 25 percent of their gross plane area perforated to compensate for the difference in the coefficient of thermal expansion between the plastic and concrete
3. Be of commercial quality

**Add between the 1st and 2nd paragraphs of section 49-3.02C(2):**

07-19-13

For CIDH concrete piles with a pile cap, the horizontal tolerance at the center of each pile at pile cut-off is the larger of 1/24 of the pile diameter or 3 inches. The horizontal tolerance for the center-to-center spacing of 2 adjacent piles is the larger of 1/24 of the pile diameter or 3 inches.

**Add 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).



## 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):**

prestressing steel

07-19-13

**Replace the 3rd paragraph of section 50-1.01D(2) with:**

The Department may verify the prestressing force using the Department's load cells.

10-19-12

**Replace the 3rd paragraph in section 50-1.01D(3) with:**

Each pressure gage must be fully functional and have an accurately reading, clearly visible dial or display. The dial must be at least 6 inches in diameter and graduated in 100 psi increments or less.

07-19-13

**Add between the 5th and 6th paragraphs of section 50-1.01D(3):**

Each jack and its gages must be calibrated as a unit.

07-19-13

**Replace the 6th paragraph in section 50-1.01D(3) with:**

Each jack used to tension prestressing steel permanently anchored at 25 percent or more of its specified minimum ultimate tensile strength must be calibrated by METS within 1 year of use and after each repair. You must:

07-19-13

1. Schedule the calibration of the jacking equipment with METS
2. Mechanically calibrate the gages with a dead weight tester or other authorized means before calibration of the jacking equipment by METS
3. Verify that the jack and supporting systems are complete, with proper components, and are in good operating condition
4. Provide labor, equipment, and material to (1) install and support the jacking and calibration equipment and (2) remove the equipment after the calibration is complete
5. Plot the calibration results

Each jack used to tension prestressing steel permanently anchored at less than 25 percent of its specified minimum ultimate tensile strength must be calibrated by an authorized laboratory within 6 months of use and after each repair.

**Add to section 50-1.01D:**

07-19-13

**50-1.01D(4) Pressure Testing Ducts**

For post-tensioned concrete bridges, pressure test each duct with compressed air after stressing. To pressure test the ducts:

1. Seal all inlets, outlets, and grout caps.
2. Open all inlets and outlets on adjacent ducts.
3. Attach an air compressor to an inlet at 1 end of the duct. The attachment must include a valve that separates the duct from the air source.
4. Attach a pressure gage to the inlet at the end of the duct.
5. Pressurize the duct to 50 psi.
6. Lock-off the air source.

7. Record the pressure loss after 1 minute.
8. If there is a pressure loss exceeding 25 psi, repair the leaks with authorized methods and retest.

Compressed air used to clear and test the ducts must be clean, dry, and free of oil or contaminants.

**50-1.01D(5) Duct Demonstration of Post-Tensioned Members**

Before placing forms for deck slabs of box girder bridges, demonstrate that any prestressing steel placed in the ducts is free and unbonded. If no prestressing steel is in the ducts, demonstrate that the ducts are unobstructed.

If prestressing steel is installed after the concrete is placed, demonstrate that the ducts are free of water and debris immediately before installing the steel.

Before post-tensioning any member, demonstrate that the prestressing steel is free and unbonded in the duct.

The Engineer must witness all demonstrations.

**50-1.01D(6) Void Investigation**

In the presence of the Engineer, investigate the ducts for voids between 24 hours and 72 hours after grouting completion. As a minimum, inspect the inlet and outlet ports at the anchorages and at high points in the tendons for voids after removal. Completely fill any voids found with secondary grout.

**50-1.01D(7) Personnel Qualifications**

Perform post-tensioning field activities, including grouting, under the direct supervision of a technician certified as a level 2 Bonded PT Field Specialist through the Post-Tensioning Institute. Grouting activities may be performed under the direct supervision of a technician certified as a Grouting Technician through the American Segmental Bridge Institute.

**Replace the 6th paragraph of section 50-1.02B with:**

07-19-13

Package the prestressing steel in containers or shipping forms that protect the steel against physical damage and corrosion during shipping and storage.

**Replace the 13th paragraph of section 50-1.02B with:**

07-19-13

Prestressing steel is rejected if surface rust either:

1. Cannot be removed by hand-cleaning with a fine steel wool pad
2. Leaves pits visible to the unaided eye after cleaning

**Replace the 4th paragraph of section 50-1.02C with:**

07-19-13

Admixtures must comply with section 90, except admixtures must not contain chloride ions in excess of 0.25 percent by weight.

**Delete the 5th paragraphs of section 50-1.02C.**

07-19-13

**Add to section 50-1.02C:**

07-19-13

Secondary grout must:

1. Comply with ASTM C 1107
2. Not have a deleterious effect on the steel, concrete, or bond strength of the steel to concrete

**Replace item 9 including items 9.1 and 9.2 in the list in the 1st paragraph of section 50-1.02D with:**

07-19-13

9. Have an inside cross-sectional area of at least 2.5 times the net area of the prestressing steel for multistrand tendons

**Replace "3/8" in item 10 in the list in the 1st paragraph of section 50-1.02D with:**

07-19-13

1/2

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):**

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).**

07-19-13

**Add to section 50-1.03B(1):**

After seating, the maximum tensile stress in the prestressing steel must not exceed 75 percent of the minimum ultimate tensile strength shown.

01-20-12

**Delete the 1st through 4th paragraphs of section 50-1.03B(2)(a).**

07-19-13

**Replace "temporary tensile strength" in the 7th paragraph of section 50-1.03B(2)(a) with:**

temporary tensile stress

07-19-13

**Add to section 50-1.03B(2)(a):**

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.

07-19-13

**Add to the list in the 2nd paragraph of section 50-1.03B(2)(c):**

3. Be equipped with permanent grout caps

07-19-13

**Replace section 50-1.03B(2)(d) with:**

**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

07-19-13

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.



**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:**

Prestressing concrete members must comply with section 50.

10-19-12

**Delete the 2nd paragraph of section 51-4.01A.**

04-20-12

**Replace the 3rd paragraph of section 51-4.01C(2) with:**

For segmental or spliced-girder construction, shop drawings must include the following additional information:

04-20-12

1. Details showing construction joints or closure joints
2. Arrangement of bar reinforcing steel, prestressing tendons, and pressure-grouting pipe
3. Materials and methods for making closures
4. Construction joint keys and surface treatment
5. Other requested information

For segmental girder construction, shop drawings must include concrete form and casting details.

**Replace "sets" in the 1st paragraph of section 51-4.01C(3) with:**

copies

04-19-13

**Delete the 3rd paragraph of section 51-4.01D.**

10-30-15

**Delete the 1st and 2nd paragraphs of section 51-4.02A.**

10-19-12

**Replace the 3rd paragraph of section 51-4.02B(2) with:**

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.

04-20-12

**Add to section 51-4.02B(2):**

At spliced-girder closure joints:

04-20-12

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.

**Delete the 1st paragraph of section 51-5.03B(3).**

07-19-13

**Delete the 2nd paragraph of section 51-5.03D(1).**

07-19-13

**Add between the 1st and 2nd paragraphs of section 51-7.01A:**

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

**Delete the 4th paragraph of section 51-7.01A.**

10-19-12

**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**

AA

**52 REINFORCEMENT**

01-15-16

**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:**

01-15-16

**52-5.01D(4) Quality Assurance Testing**

Secure, identify, and transport QA headed bar reinforcement test samples to METS as specified for production test samples in section 52-5.01D(3).

The Department tests headed bar reinforcement as specified for production testing in section 52-5.01D(3).



## 53 SHOTCRETE

01-15-16

Replace "632" in item 1 in the list in the 3rd paragraph of section 53-1.02 with:

01-15-16

675

Replace item 2 in the list in the 3rd paragraph of section 53-1.02 with:

01-15-16

2. You may substitute a maximum of 30 percent coarse aggregate for the fine aggregate. Coarse aggregate must comply with section 90-1, except section 90-1.02C(4)(d) does not apply. Grading for the coarse aggregate must comply with the grading specified in section 90-1.02C(4)(b) for the 1/2 inch x No. 4 or the 3/8 inch x No. 8 primary aggregate nominal size.

Replace "shotcrete" in the 2nd sentence of the 4th paragraph of section 53-1.02 with:

01-15-16

concrete

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.



## 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

copies

**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.

**Delete the 1st and 2nd sentences in the 3rd paragraph of section 55-1.01C(3).**

07-19-13

**Replace the 4th paragraph of section 55-1.01C(3) with:**

07-19-13

Remove material for test samples in the Engineer's presence. Test samples for plates over 24 inches wide must be 10 by 12 inches with the long dimension transverse to the direction of rolling. Test samples for other products must be 12 inches long taken in the direction of rolling with a width equal to the product width.

**Replace the 1st sentence of the 6th paragraph in section 55-1.01C(3) with:**

07-19-13

Results of check testing are delivered to you within 20 days of receipt of samples at METS.

**Delete the 2nd paragraph of section 55-1.01D(1).**

07-19-13

**Replace the 2nd sentence of the 4th paragraph in section 55-1.01D(1) with:**

07-19-13

The calibration must be performed by an authorized repair and calibration center approved by the tool manufacturer.

**Add to section 55-1.01D(1):**

07-19-13

For bolts installed as snug tight, rotational capacity testing and installation tension testing are not required.

In addition to NDT requirements in AWS D1.5, ultrasonically test 25 percent of all main member tension butt welds in material over 1/2 inch thick.

Perform NDT on 100 percent of each pin as follows:

1. MT under ASTM A 788, S 18, with no linear indication allowed exceeding 3 mm
2. UT under ASTM A 788, S 20, level S and level DA in two perpendicular directions

The Engineer determines the location of all NDT testing for welding.

**Delete the 2nd paragraph of section 55-1.01D(3)(a).**

07-19-13

**Delete the 7th paragraph of section 55-1.01D(3)(b)(i).**

10-30-15

**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

<b>Structural Steel</b>	
<b>Material</b>	<b>Specification</b>
Carbon steel	ASTM A 709/A 709M, Grade 36 or {ASTM A36/A36M} <sup>a</sup>
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} <sup>a</sup>
HS low alloy structural steel	ASTM A 709/A 709M, Grade 50W or Grade HPS 50W, or {ASTM A 588/A 588M} <sup>a</sup>
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} <sup>a</sup>

<sup>a</sup>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 <sup>a</sup>
HS bolts and studs	ASTM A 449, Type 1 <sup>a</sup>
HS threaded rods	ASTM A 449, Type 1 <sup>a</sup>
HS nonheaded anchor bolts	ASTM F 1554, Grade 105, Class 2A <sup>a</sup>
Nuts	ASTM A 563, including appendix X1 <sup>b</sup>
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 <sup>b</sup>
Hardened washers	ASTM F 436, Type 1, Circular, including S1 supplementary requirements
Direct tension indicators	ASTM F 959, Type 325, zinc-coated

<sup>a</sup>Use hardened washers.

<sup>b</sup>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 <sup>a</sup>
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 <sup>b</sup>	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

<sup>a</sup>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.

<sup>b</sup>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 °F
Grade 50 <sup>a</sup> (Thickness up to 2 inches)	15 at 40 °F
Grade 50W <sup>a</sup> (Thickness up to 2 inches)	15 at 40 °F
Grade 50 <sup>a</sup> (Thickness over 2 inches up to 4 inches )	20 at 40 °F
Grade 50W <sup>a</sup> (Thickness over 2 inches up to 4 inches)	20 at 40 °F
Grade HPS 50W <sup>a</sup> (Thickness up to 4 inches)	20 at 10 °F
Grade HPS 70W (Thickness up to 4 inches)	25 at -10 °F
Grade 100 (Thickness of 2-1/2 inches or less)	25 at 0 °F
Grade 100W (Thickness over 2-1/2 inches up to 4 inches)	35 at 0 °F
Grade HPS 100W (Thickness of 2-1/2 inches or less)	25 at -30 °F
Grade HPS 100W (Thickness over 2-1/2 inches up to 4 inches)	35 at -30 °F

<sup>a</sup>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.

**Delete the 3rd and 4th sentences in the 2nd paragraph in section 55-1.02A(5).**

07-19-13

**Replace the 1st paragraph of section 55-1.02B(1) with:**

07-19-13

Section 55-1.02B(1) applies to work performed at the source and at the job site.

**Replace the 4th paragraph in section 55-1.02B(1) with:**

07-19-13

Ends of girder stiffeners shown as tight-fit must bear on the girder flange with at least point bearing. Local clearances between the end of the stiffener and the girder flange must be at most 1/16 inch.

**Replace the 1st sentence of the 5th paragraph in section 55-1.02B(1) with:**

07-19-13

Fabricate floor beams, stringers, and girders having end connection angles to exact length back to back of connection angles.

**Add to the 7th paragraph in section 55-1.02B(1):**

07-19-13

Use low-stress stamps for fracture critical members and tension members.

**Replace the 2nd sentence of the 9th paragraph in section 55-1.02B(1) with:**

07-19-13

Slightly round edges and sharp corners, including edges marred, cut, or roughened during handling or erection.

**Replace the 3rd paragraph 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.

**Delete the 3rd paragraph in section 55-1.02B(7)(a).**

07-19-13

**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.



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:**

copies

04-19-13

**Replace the 1st and 2nd paragraphs of section 56-3.01D(2)(b) with:**

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.

10-30-15

**Replace the 4th paragraph of section 56-3.02B with:**

Structural tubing and hollow structural sections must be structural steel complying with ASTM A500/A500M, Grade B or ASTM A1085.

10-30-15

**Delete the 7th paragraph of section 56-3.02K(2).**

07-20-12

**Replace the 1st paragraph of section 56-3.02M(1) with:**

Galvanize all ferrous metal parts of the following sign structure types:

1. Truss
2. Bridge mounted
3. Tubular

07-19-13

**Add between the 1st and 2nd paragraphs of section 56-3.02M(1):**

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.

04-19-13





**Replace "SSPC-QP 3 or AISC SPE, Certification P-1 Enclosed" in item 3 in the list in the 1st paragraph of section 59-2.01D(1) with:**

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:**

02-12-16

Clean and paint all exposed structural steel and other metal surfaces.

Cleaning and painting of new structural steel must be performed in an Enclosed Shop as defined in AISC-420-10/SSPC-QP 3.

**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 <sup>a</sup>	Exterior grade latex <sup>b</sup> , 2 coats	2 minimum each coat, 4–8 total
Total thickness, all coats		8–14
Connections to existing structural steel: <sup>c</sup>		
Undercoat	Inorganic zinc primer, AASHTO M 300 Type I or II	4–8
Finish coat <sup>a</sup>	Exterior grade latex <sup>b</sup> , 2 coats	2 minimum each coat, 4–8 total
Total thickness, all coats		8–14

<sup>a</sup>If no finish coats are described, a final coat of inorganic zinc primer is required.

<sup>b</sup>Exterior grade latex must comply with section 91-2.02 unless otherwise specified.

<sup>c</sup>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:**

*Specification for Structural Joints Using High-Strength Bolts*

07-19-13

**Add to section 59-2.03C:**

**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:

04-19-13

**State Specification PWB Coating System**

Surface	Description	State Specification PWB Coating	Dry film thickness (mils)
Surfaces cleaned to bare metal <sup>a</sup> :	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

<sup>a</sup>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:**

soldier

04-19-13

**Replace section 59-11 with:**

**59-11 STAINING GALVANIZED SURFACES**

07-19-13

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.







**Replace the row under "Rock class" in the table in the 2nd paragraph of section 72-3.03E with:**

1/2 T	1/4 T	Light	Facing	Cobble
-------	-------	-------	--------	--------

01-20-12

**Delete the 5th and 6th paragraphs of section 72-11.01B.**

07-19-13

**Add to section 72-11.01B:**

Expanded polystyrene and premolded expansion joint filler must comply with section 51-2.

01-18-13

**Delete the 2nd paragraph of section 72-11.01C(1).**

07-19-13

**Delete the 7th paragraph of section 72-11.01C(1).**

07-19-13

**Add between the 7th and 8th paragraphs of section 72-11.01C(1):**

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.

07-19-13

**Replace the 8th paragraph of section 72-11.01C(1) with:**

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.

07-19-13

**Replace the 1st paragraph of section 72-11.01C(2) with:**

Construct and finish minor concrete slope paving under section 51-1.

01-18-13

**Replace the 3rd paragraph of section 72-11.01C(2) with:**

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.**

07-19-13





**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.



**Add between "splices at" and "posts" in the 5th paragraph of section 83-1.02B:**

07-19-13

midspar 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.

**Delete "chromated copper arsenate," in the 1st sentence of the 14th paragraph of section 83-1.02B.**

10-30-15

**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.

**Delete items 6 and 7 in the list in the 25th paragraph of section 83-1.02B.**

07-19-13

**Delete "A 441," in item 5 in the list in the 26th paragraph of section 83-1.02B:**

10-30-15

**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:**

Type WB-31

07-19-13

**Replace "metal" at each occurrence in the 2nd paragraph of section 83-1.02B(2) with:**

rail

10-30-15

**Replace the heading of section 83-1.02B(3) with:**

**Temporary Midwest Guardrail System**

07-19-13

**Replace the 2nd sentence of the 9th paragraph of section 83-1.02D(1) with:**

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.

07-18-14

**Replace "80-2.02" in the 2nd paragraph of section 83-1.02E with:**

80-3.02B

10-19-12

**Replace the 3rd paragraph of section 83-1.02G(2) with:**

Stud bolts must comply with the specifications for studs in clause 7 of AWS D1.1.

07-18-14

**Replace the 7th paragraph of section 83-1.02G(2) with:**

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

10-30-15

**Replace "horizontal" in the 8th paragraph of section 83-1.02G(2) with:**

vertical

07-18-14

**Replace the 10th paragraph of section 83-1.02G(2) with:**

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.**

10-30-15

**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

**Delete the 2nd paragraph of section 83-2.01.**

10-30-15

**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).



## 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  $250 \text{ mcd}\cdot\text{m}^{-2}\cdot\text{lx}^{-1}$  for white and  $125 \text{ mcd}\cdot\text{m}^{-2}\cdot\text{lx}^{-1}$  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

AA

## 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.

**Delete item 15.3 in the list in the 1st paragraph of section 86-2.04B(3).**

07-19-13

**Add between "Exposed" and "conduit" in the 2nd paragraph of section 86-2.05B:**

07-19-13

Type 1

**Replace the 1st sentence of the 10th paragraph of section 86-2.05C with:**

07-19-13

After installing conduit, install the pull tape.

**Replace the 1st sentence of the 15th paragraph of section 86-2.05C with:**

11-15-13

Conduit runs shown to be located behind curbs may be installed in the street within 3 feet of and parallel to the face of the curb by the trenching in pavement method.

**Replace the 1st and 2nd sentences of the 2nd paragraph of section 86-2.05D with:**

07-19-13

Install an expansion-deflection fitting for expansion joints with a 1-1/2-inch movement rating. The fitting must be watertight and include a molded neoprene sleeve, a bonding jumper, and 2 silicon bronze or zinc-plated iron hubs.

**Replace section 86-2.06 with:**

07-19-13

**86-2.06 PULL BOXES**

**86-2.06A General**

**86-2.06A(1) Cover Marking**

The cover marking must be clearly defined, uniform in depth, and parallel to either the long or short sides of the cover.

Marking letters must be 1 to 3 inches high.

Before galvanizing steel or cast iron cover, apply marking by one of the following methods:

1. Use cast iron strip at least 1/4 inch thick with letters raised a minimum of 1/16 inch. Fasten strip to cover with 1/4-inch flathead stainless steel machine bolts and nuts. Peen bolts after tightening.
2. Use sheet steel strip at least 0.027 inch thick with letters raised a minimum of 1/16 inch. Fasten strip to cover by spot welding, tack welding, or brazing, with 1/4-inch stainless steel rivets or 1/4-inch roundhead stainless steel machine bolts and nuts. Peen bolts after tightening.
3. Bead weld the letters on cover such that the letters are raised a minimum of 3/32 inch.

#### **86-2.06A(2) Installation and Use**

Space pull boxes no more than 200 feet apart. You may install additional pull boxes to facilitate the work.

You may use a larger standard size pull box than that shown on the plans or specified.

A pull box in ground or sidewalk area must be installed as follows:

1. Embed bottom of the pull box in crushed rock.
2. Place a layer of roofing paper on the crushed rock.
3. Place grout over the layer of roofing paper. Grout must be 0.50 to 1 inch thick and sloped toward the drain hole.
4. Make a 1-inch drain hole in the center of the pull box through the grout and roofing paper.
5. Place grout between the pull box and the pull box extension, and around conduits.

The top of the pull box must be flush with the surrounding grade or the top of an adjacent curb, except in unpaved areas where the pull box is not immediately adjacent to and protected by a concrete foundation, pole, or other protective construction. Place the pull box 1-1/4 inches above the surrounding grade.

Where practical, place a pull box shown in the vicinity of curbs or adjacent to a standard on the side of the foundation facing away from traffic. If a pull box is installed in a sidewalk area, adjust the depth of the pull box so that the top of the pull box is flush with the sidewalk.

Reconstruct the sump of an existing pull box if disturbed by your activities. Remove old grout and replace with new if the sump was grouted.

#### **86-2.06B Non-Traffic Pull Boxes**

Reserved

#### **86-2.06C Traffic Pull Boxes**

The traffic pull box and cover must comply with ASTM C857, "Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures," for HS20 loading. You must be able to place the load anywhere on the box and cover for 1 minute without causing cracks or permanent deformations.

Frame must be anchored to the box with 1/4 by 2-1/4 inch concrete anchors. Four concrete anchors must be included for No. 3-1/2(T) pull box; one placed in each corner. Six concrete anchors must be included for No. 5(T) and No. 6(T) pull boxes; one placed in each corner and one near the middle of each of the longer sides.

Nuts must be zinc-plated carbon steel, vibration resistant, and have a wedge ramp at the root of the thread.

After installation of traffic pull box, install the steel cover and keep it bolted down when your activities are not in progress at the pull box. When the steel cover is placed for the final time, the cover and Z bar frame must be cleaned of debris and tightened securely.

Steel cover must be countersunk approximately 1/4 inch to accommodate the bolt head. When tightened, the bolt head must not exceed more than 1/8 inch above the top of the cover.

Concrete placed around and under traffic pull boxes must be minor concrete.

**Replace the 11th row in the table in the 1st paragraph of section 86-2.08B with:**

07-19-13

Grounded circuit conductor	Pedestrian push buttons	Wht	Blk	NBR	14
	Signals and multiple lighting	Wht	None	NBR	10
	Flashing beacons and sign lighting	Wht	None	NBR	12
	Lighting control	Wht	None	C-3	14
	Service	Wht	None	NBR	14

**Replace the 1st sentence of the 1st paragraph of section 86-2.08C with:**

07-19-13

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

**Add to the beginning of section 86-2.09A:**

07-19-13

Provide enough traffic signal light conductors for functional operation of the signal. Provide 3 spare conductors in all conduits containing traffic signal light conductors.

**Replace the paragraphs in section 86-2.09C with:**

07-19-13

Connectors must be crimp type. Use a manufacturer-recommended tool for connectors and terminals to join conductors. Comply with SAE-AS7928.

Terminate stranded conductors smaller than no. 14 in crimp style terminal lugs.

Terminate field conductors no. 12 and smaller with spade type terminals. Terminate field conductors no. 10 and larger with spade type or ring type terminals.

**Replace the value for resistivity in the table in the 6th paragraph of section 86-2.09E with:**

07-19-13

$25 \times 10^{13} \Omega$  per inch, minimum

**Add between "the" and "head" in the 3rd sentence of the 2nd paragraph of 86-2.09F:**

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.

**Delete item 1 in the list in section 86-4.01D(1)(b).**

07-19-13

**Replace the paragraphs in section 86-4.01D(1)(c)(i) with:**

07-19-13

LED signal modules must be on the Authorized Material List for LED traffic signals.

The Department tests modules under section 86-2.14A, ANSI/ASQ Z1.4, and:

1. California Test 604 for LED and circular LED signal modules
2. California Test 3001 for arrow, U-turn, and bicycle LED signal modules

The LED signal modules submitted for testing must be typical production units. LEDs must be spread evenly across the module.

The Department may test the modules on all parameters specified in section 86-4.01D.

**Replace the 1st and 2nd sentences of the 3rd paragraph of 86-4.01D(2)(b) with:**

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.

**Delete items 1 and 4 in the list in section 86-4.03I(1)(b).**

07-19-13

**Replace the paragraphs of section 86-4.03I(1)(c)(i) with:**

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:**

Reserved

10-17-14

**Add between "beacon" and "must" in the 1st sentence of section 86-4.05:**

signal face

07-19-13

**Delete "face" in item 1 in the list in the 1st paragraph of section 86-4.05.**

07-19-13

**Replace the row for viscosity in the table in the 2nd paragraph of section 86-5.01A(3)(c) with:**

Viscosity, Brookfield Thermosel, no. 27 Spindle, 20 rpm, 190 °C	D 4402	2.5–3.5 Pa·s
--	--------	--------------

07-19-13

**Replace the paragraph in section 86-5.01A(3)(d) with:**

Use epoxy sealant for repair work in and around sawcuts housing inductive loops.

07-19-13

**Replace "all loop conductors" in the 3rd paragraph of section 86-5.01A(4) with:**

the detector lead-in cable

07-19-13

**Replace "Encase the loop wires" in the 1st sentence of the 3rd paragraph of section 86-5.01A(5) with:**

The loop wires must be encased

07-19-13

**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.



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 <sup>-1</sup> 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 <sup>-1</sup> 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:

<b>Biaxial Geogrid</b>		
Property	Test	Value
Aperture size, inch <sup>a</sup> 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 <sup>a</sup> min	ASTM D 6637	410 x 620
Tensile strength at ultimate, lb/ft <sup>a</sup> 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 <sup>a</sup> 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 <sup>b</sup> min	GRI:GG9	0.65

<sup>a</sup>Machine direction x cross direction

<sup>b</sup>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:



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 <sup>a</sup>	ASTM C117	
Moisture content of fine aggregate	ASTM C566, or electronically actuated moisture meter <sup>b</sup>	1–2 times per each day of pour, depending on conditions

<sup>a</sup>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.

<sup>b</sup>Electronically actuated moisture meter must be calibrated once per week per ASTM C566.

### Concrete QC Tests

Property	Test method	Minimum testing frequency
Compressive strength <sup>b</sup>	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 <sup>a</sup>	If concrete is air entrained, once for each set of cylinders, and when conditions warrant

<sup>a</sup>ASTM C173/C173M must be used for lightweight concrete.

<sup>b</sup>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.



## 92 ASPHALTS

07-19-13

Replace "Reserved" in section 92-1.01B with:

07-19-13

**modified asphalt binder:** Asphalt binder modified with polymers, crumb rubber, or both.

Replace the row for dynamic shear for original binder in the table in the 1st paragraph of section 92-1.02B with:

01-20-12

Dynamic shear, Test temperature at 10 rad/s, °C	T 315	58	64	64	64	70
min G*/sin(delta), kPa		1.00	1.00	1.00	1.00	1.00
max G*/sin(delta), kPa		2.00	2.00	2.00	2.00	2.00

**Replace 2nd paragraph of section 92-1.02B with:**

07-19-13

PG modified asphalt binder must comply with the requirements shown in the following table:

**PG Modified Asphalt Binder**

Property	AASHTO Test Method	Grade		
		PG 58-34 M	PG 64-28 M	PG 76-22 M
<b>Original Binder</b>				
Flash point, min °C	T 48	230	230	230
Solubility, min %	T 44 <sup>a</sup>	97.5	97.5	97.5 <sup>b</sup>
Viscosity at 135 °C <sup>c</sup> , 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 <sup>d</sup> , Mass loss, max, %	T 240	1.00	1.00	1.00
<b>RTFO Test Aged Binder</b>				
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 <sup>e</sup>	80 <sup>e</sup>	80 <sup>e</sup>
Elastic recovery <sup>f</sup> , Test temperature °C min recovery, %	T 301	25 75	25 75	25 65
PAV <sup>g</sup> , temperature, °C	R 28	100	100	110
<b>RTFO Test and PAV Aged Binder</b>				
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

